-

A Summary of Current Program, 9/1/64
and Preliminary Report of Progress
for 9/1/63 to 9/1/64

FARM PRODUCTION ECONOMICS DIVISION
of the
ECONOMIC RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

This progress report of U.S.D.A. and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on U.S.D.A. and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of U.S.D.A. and cooperative research issued between September 1, 1963, and September 1, 1964. Current research findings are also published in the ERS publications The Farm Index, a monthly, and Agricultural Economics Research, a quarterly. This progress report was compiled in the Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, Washington, D. C. 20250

UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
September 1, 1964

TABLE OF CONTENTS

Farm production economics research, as used in this report, deals with many and varied economic problems of agricultural production. The work is concerned with the economics of organization and management of farms, use of capital and labor in agriculture, production and conservation practices, adjustments in production and resource use, farm financial problems of credit, insurance, and taxation, and appraisal of alternative production policies and programs.

Rapid technological change in agriculture and the tendency for farm production to outstrip growing demands for products gives rise to continued need for economic adjustments in our farm economy. Farms are decreasing in number and increasing in size and degree of specialization. Farm machinery, fertilizers, and other innovations, are substituting for land and labor. Coupled with rising farmland values, these developments necessitate large and increasing capital investments per farm, and alter farm credit and insurance needs. The great changes occurring in rural communities--some pressed by rapid urban and industrial expansion, for example; others faced with sharply declining populations--are arousing increasing concern in rural people over local government and taxation. These trends challenge the most rigorous research in the field of farm economics. Results of research in this field are widely used as aids in management and policy decisions at the farm, area, regional, State, and national levels.

The Department's program of research and related statistical reporting in farm production economics is conducted from headquarters in Washington, D. C., and is concerned chiefly with problems of regional and national scope. Field studies generally are conducted in cooperation with State experiment stations. When studies are made jointly by Federal and State workers, Federal people usually are most interested in regional and national applications of results, while State workers are most often interested in local applications. Close working relationships between Federal and State agencies have long been traditional in this field. This close cooperation in planning and conducting the work reflects joint and cooperative efforts rather than overlapping or duplication of effort.

The farm production economics research program is covered under 10 area headings shown in the Table of Contents. More detailed subject-matter subheadings are given in the discussion of each area of work.

In the 12 months since progress was last reported to research advisory committees, the special policy and program contributions that the Division

has been able to make have been significant. Division personnel have responded to many requests for assistance from the Office of the Secretary, program administrators, the National Agricultural Advisory Commission, and others. In addition, many of the Division's continuing statistical series and analyses have become increasingly important in efforts to understand changes and achieve improvements in the structure and in the well being of American agriculture.

Some illustrative examples of Division research contributions during the reporting period follow.

Minimum Resources for Specified Operator Earnings. How much land and capital must a farmer have to earn a given income for his work and management? The answer varies by type of farm. Major types of farm in 29 selected areas were evaluated for four levels of operator earnings: \$2,500, \$3,500, \$4,500, and \$5,500. The data used characterize the more progressive farms, rather than average or typical situations. To earn \$2,500 farmers had to have annual gross sales from \$6,750 to \$26,450--nearly all were above \$10,000. To earn \$5,500, gross sales had to be from \$14,990 to \$62,100; most exceeded \$20,000. To earn \$5,500, the required investment in land, buildings, livestock, and equipment ranged from \$28,270 to \$353,150; investment exceeded \$100,000 on eight of the farms. At the \$2,500 level of earnings, total investment ranged from \$12,050 to \$160,300; it exceeded \$50,000 in 12 of the 29 areas. Investment capital cost on the farms budgeted was calculated at 5 percent per year. At this rate, returns to capital were frequently greater than returns to operator labor and management. Thus, farm families who have a large equity have considerably more income for family living than those who have little equity and have to depend largely on labor and management earnings.

The Expanding and Contracting Sectors of American Agriculture. A recently completed analysis of changes in the size and numbers of farms shows that agriculture has been dividing into an expanding sector of larger farms and a contracting sector of smaller farms. Measured in terms of gross sales per farm, the number of farms with \$10,000 or more of sales, most of which are family farms, increased 159 percent between 1939 and 1959. While this sector of agriculture is growing, the average marketings per farm increased only 20 percent which indicates that agriculture is not becoming dominated by excessively large units. The total number of farms declined from 5.8 million in 1939 to about 3.4 million in 1964. Virtually all of this decrease occurred in the group of farms producing less than \$2,500 worth of sales per farm. The dividing line between the growing sector of American agriculture and the declining sector was at about \$5,000 worth of sales per farm in the 1940's. In the 1950's the dividing line has moved up to about \$10,000 worth of sales per farm and will likely continue to rise in line with technological advances and increasing standards of living.

Credit for Rural Homes. Studies in Missouri and Montana reveal in detail the problem of financing homes in rural areas and small towns. In rural communities of both States small country banks usually are the only lending institutions. Because of their limited resources they can make few home loans. Their loans typically are for about half the value of the property, with repayment required in 5 years. The long-term, liberal loans made to urban home owners by life insurance companies and large city banks backed by the Federal Housing Administration or Veterans Administration are seldom available to rural people. Lack of institutional facilities to channel credit from the larger lenders and financial centers and the high cost of making and servicing rural loans are the chief factors limiting credit for rural housing. Greater risks may be a factor but most lenders reported repayments by country owners to be as good as by city owners. To improve the situation, local lenders, particularly bankers, can help attract outside funds from specialized mortgage lenders--life insurance companies, savings and loan associations, and mutual savings banks--by making and servicing loans for others and by assembling blocks of scattered loans to reduce costs. At present, the rural housing program of the Farmers Home Administration helps fill an important need.

Federal Crop Insurance. Field evaluation studies made at the request of the Federal Crop Insurance Corporation in Virginia and Montana show that crop insurance indemnities prevented serious credit and financial difficulties for many farmers who had suffered heavy losses due to drought. Crop insurance was particularly helpful to specialized producers and those depending heavily on credit. Those without insurance frequently had substantial reserves or could spread their risks through diversification or nonfarm employment. Lenders reported that crop loss payments enabled many insured borrowers who would otherwise have been unable to do so, to repay operating loans and obtain new crop loans. Insurance indemnities also reduced the funds needed for the emergency loan program of the Farmers Home Administration. An expanded Federal crop insurance program, however, probably would not eliminate completely the need for some emergency loans under drought conditions as severe as existed in Montana and Virginia in 1963.

Prospective Agricultural Production and Food Processing in the Pacific Northwest. To aid the Bonneville Power Administration estimate future power needs in the Pacific Northwest, projections of agricultural production and food processing were made at that agency's request. The project was cooperative with the Marketing Economics Division of the Economic Research Service. Agriculture in the region is expected to continue a trend toward greater specialization and intensification in production. More irrigated land and clearing of cut-over forest areas will provide some expansion. Between 1957-61 and 1985, projected increases in the production of crops range from 50 percent for small grains to 140 percent for vegetables; 30 to 45 percent for hogs, and dairy and poultry products; and 175 percent for cattle and calves. An increase of about 85

percent in the processing of agricultural products is also expected to satisfy an increasing demand for highly finished food products without incurring transportation costs for inshipments. The increased production is expected to be accomplished with fewer farmworkers on about 40 percent fewer, but larger farms. Employment in processing plants is also expected to decline because of an average annual increase of 2 to 4 percent in output per worker.

Credit for Rural Homes. Studies in Missouri and Montana reveal in detail the problem of financing homes in rural areas and small towns. In rural communities of both States small country banks usually are the only lending institutions. Because of their limited resources they can make few home loans. Their loans typically are for about half the value of the property, with repayment required in 5 years. The long-term, liberal loans made to urban home owners by life insurance companies and large city banks backed by the Federal Housing Administration or Veterans Administration are seldom available to rural people. Lack of institutional facilities to channel credit from the larger lenders and financial centers and the high cost of making and servicing rural loans are the chief factors limiting credit for rural housing. Greater risks may be a factor but most lenders reported repayments by country owners to be as good as by city owners. To improve the situation, local lenders, particularly bankers, can help attract outside funds from specialized mortgage lenders--life insurance companies, savings and loan associations, and mutual savings banks--by making and servicing loans for others and by assembling blocks of scattered loans to reduce costs. At present, the rural housing program of the Farmers Home Administration helps fill an important need.

Federal Crop Insurance. Field evaluation studies made at the request of the Federal Crop Insurance Corporation in Virginia and Montana show that crop insurance indemnities prevented serious credit and financial difficulties for many farmers who had suffered heavy losses due to drought. Crop insurance was particularly helpful to specialized producers and those depending heavily on credit. Those without insurance frequently had substantial reserves or could spread their risks through diversification or nonfarm employment. Lenders reported that crop loss payments enabled many insured borrowers who would otherwise have been unable to do so, to repay operating loans and obtain new crop loans. Insurance indemnities also reduced the funds needed for the emergency loan program of the Farmers Home Administration. An expanded Federal crop insurance program, however, probably would not eliminate completely the need for some emergency loans under drought conditions as severe as existed in Montana and Virginia in 1963.

Prospective Agricultural Production and Food Processing in the Pacific Northwest. To aid the Bonneville Power Administration estimate future power needs in the Pacific Northwest, projections of agricultural production and food processing were made at that agency's request. The project was cooperative with the Marketing Economics Division of the Economic Research Service. Agriculture in the region is expected to continue a trend toward greater specialization and intensification in production. More irrigated land and clearing of cut-over forest areas will provide some expansion. Between 1957-61 and 1985, projected increases in the production of crops range from 50 percent for small grains to 140 percent for vegetables; 30 to 45 percent for hogs, and dairy and poultry products; and 175 percent for cattle and calves. An increase of about 85

percent in the processing of agricultural products is also expected to satisfy an increasing demand for highly finished food products without incurring transportation costs for inshipments. The increased production is expected to be accomplished with fewer farmworkers on about 40 percent fewer, but larger farms. Employment in processing plants is also expected to decline because of an average annual increase of 2 to 4 percent in output per worker.

AREA NO. 1. AGRICULTURAL ADJUSTMENTS, PRODUCTION RESPONSE AND FARM PROGRAM APPRAISAL

Problem. A chronic major problem in agriculture is to adjust production, both in the aggregate and for major commodities, to market outlets. Achievement of economic balance in agriculture and adequate returns to farmers is likely to be especially difficult over the next five to ten years because the capacity of agriculture to produce likely will more than keep pace with the food and fiber requirements of the anticipated larger population. Some resources now used in over-expanded lines of production need to be shifted or be more efficiently used. Individual farmers can reduce costs per unit of product by reorganizing farm enterprises, adopting improved technology, and increasing the size of their farms. But when many farmers do this, total output mounts and the problem of bringing total supply in line with total demand is intensified. Thus adjustment opportunities cannot be considered solely from the viewpoint of the individual farmer. National and regional aggregate production response are important in considering the farm adjustment problem. Analyses of profitable adjustments on representative farms and estimates of both the aggregate output that would be forthcoming if all farms were efficiently organized and operated, and the aggregate response that farmers be expected to make, are needed as a basis for evaluating the adjustments that would be profitable both to individual farmers and to the industry under different economic situations and for appraising the effects of alternative farm adjustment programs. Continuing analysis of trends in farm output and resource productivity is also needed to measure changes in the farm situation.

USDA AND COOPERATIVE PROGRAM

The program encompasses four major types of work. Studies of national and regional productivity conducted in Washington, D.C. analyze the factors responsible for changes in total output and resource productivity for the Nation and for 10 broad farm production regions. These studies become the basis for long-term projections of prospective trends in farm output and productivity, in numbers of farms, and in other major characteristics of the Nation's agriculture. Studies of production response and needs for adjustment are conducted in Washington, D.C. and at several field locations. These studies emphasize the methodological developments required to appraise the production response farmers are likely to make individually and in the aggregate to changes in technology, prices, programs, and other factors. Attention is also given to the optimum (least cost) regional distribution of crop and livestock production. Area adjustment studies in dairy, cotton, wheat, rice and feed-livestock areas emphasize the determination of the most profitable adjustments for representative farms to alternative combinations of prices. The most profitable organizations weighted by the proportion of the population represented by each typical farm provide first approximations of the area implication of individual farm adjustments. These studies are conducted in

cooperation with 15 State agricultural experiment stations in dairy areas, 12 in cotton areas, 10 in wheat areas, and 22 in feed-livestock areas. Studies of adjustment opportunities in rice areas are conducted in Arkansas, Louisiana, Mississippi, and Texas. Studies of agricultural policies and program appraisals are oriented toward an understanding of the impacts and means of improving programs and policies at the national level, including the acreage allotment programs, wheat programs, the probable effect of alternative sugar quota and pricing policies, prospective use of land released from the Conservation Reserve, and impacts of the current feed grain program. This work involved formal cooperation with 12 State experiment stations.

A total of 64.6 Federal professional man-years are devoted to this area of work: 6.0 man-years to national and regional productivity in agriculture; 12.4 man-years to appraisal of production response and needs for adjustment; 5.1 man-years to appraisal of adjustments in dairy areas; 7.7 man-years to adjustments in cotton areas; 7.8 man-years to adjustments in wheat areas; 3.0 man-years to adjustments in rice areas; 13.4 man-years to adjustments in feed-livestock areas; 2.9 man-years to appraisals of agricultural policies and programs; and 6.3 man-years to program leadership. A research contract was entered into with the University of Wisconsin for a study to develop an improved econometric model for explaining aggregate farm production response.

PROGRAM OF STATE EXPERIMENT STATIONS

Practically all State experiment stations have research underway dealing with long-range trends and adjustments in agriculture relative to current and prospective changes in economic and technological conditions and institutional factors such as farm programs. These studies involve the analysis of profitable adjustments on representative farms and the most likely aggregate production response for a given area, industry, State or region when farmers reorganize resources in an optimum manner. These studies also consider the demand for land, labor, and capital used in agricultural production and the numbers, types, sizes, and locations of farms required under prospective changes in the economic environment. Adjustment research is oriented toward the major production areas of dairy, cotton, wheat, rice, feed grains, and livestock.

A considerable segment of adjustment work is conducted as cooperative regional research between the State experiment stations and the U. S. Department of Agriculture. This type of research is presently underway in each of the four major regions. Research underway in the Southern Region deals with an appraisal of farming adjustment to meet changing conditions. These studies are concerned with the alternatives available for the profitable use of available resources which have become excessive in considerable part due to Government cotton programs. Research in the Western Region stresses the relative profitability of alternative farming opportunities in relation to limited water supply and Government programs

while that in the North Central States involves an analysis of adjustment alternatives on grain farms. In many instances these studies have considered the income opportunities available to farmers and to industries in adjusting crop acres to livestock production. Studies in the Northeast are primarily concerned with dairy adjustment needs and opportunities at both the firm and industry levels to meet changing economic and technological conditions. A recent move is underway to improve the comparability of data between regional groups and to develop methodology for the measurement of national aggregate resource organization and production response relative to changing conditions.

The total State effort devoted to this area of research is 69.44 professional man-years of which 60.42 is for agricultural adjustment and production response and 9.02 for farm program appraisal.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. National and Regional Productivity in Agriculture

Preliminary estimates of total farm output indicate that 1964 will be the second highest of record and only 1 percent below 1963. Livestock production set a new record for the fourth consecutive year, with milk production up 1 percent from 1963, poultry output up 3 percent, and meat animals at the record level of 1963, with lower pork production offset by higher beef production. Crop production in 1964 is 3 percent smaller than in 1963. Feed grains are down 10 percent, due to a reduced acreage and less favorable yields. Food grains are up 12 percent, and sugar reached a new high output. Cropland used for crops remained at the 1963 level, and the 1964 crop production per acre was exceeded only in 1963.

U. S. farmers in 1963 used about 1 percent more inputs than in 1950, but these inputs were 30 percent more productive. Although the total volume of farm production inputs changed very little during this period, the composition of these inputs changed markedly. Farm labor decreased more than 40 percent from 1950 to 1963, while fertilizer and lime nearly doubled, and inputs of mechanized power and machinery rose 15 percent. The volume of purchased inputs (production items requiring cash expenditures) used by farmers in 1963 was one-third greater than in 1950. Econometric analysis continues on aggregate resource adjustments in U. S. agriculture. A manuscript covering the first phase of this study was published under the title "Excess Capacity in U. S. Agriculture." The major emphasis of the study is now being centered on the relationships between farm production inputs and output. Work is progressing on the estimation of an aggregate U. S. farm production function and analysis of its usefulness in specifying least-cost combinations of inputs, changes in factor efficiency, and input-demand and product-supply parameters.

A manuscript on the effects of weather on corn yields in the Corn Belt has been completed. Weather indexes, which can be used to adjust actual corn yields for the influence of variations in weather conditions, were constructed for the period 1929 to 1962. Crop yields, when adjusted for the effects of weather variations, furnish an estimate of the effects of improved technology. Adjusted corn yields in the Corn Belt have risen from an average of 30 bushels in 1929 to about 70 bushels in the early 1960's. The use of hybrid seed accounted for about 18 bushels of this 40-bushel increase. Greater use of nitrogen fertilizer added approximately another 15 bushels. The remaining increase was due to the stepped-up rate of planting and other inputs.

Reappraisals of prospective increases in crop yields concluded that average yields may exceed 80 bushels of corn by 1970, around 50 bushels of sorghum grain, 30 bushels of wheat, 27 bushels of soybeans, and 575 pounds of cotton lint. An appraisal of the prospective improvements in feed conversion rates in poultry production indicates that it may take from 14 to 22 percent less feed grains per unit of output in 1975 than now. The extent of the change will depend largely on the rate of improvement in the average poultryman's managerial ability, and on how fast improved methods of feeding, breeding and disease control are developed and made available to the poultry industry. Poultry now use about one-sixth of all feed grains fed to livestock in the U. S., and one-fifth of all concentrates fed.

A study of prospective agricultural production and food processing in the Pacific Northwest was completed. To aid the Bonneville Power Administration to estimate future power needs in the Pacific Northwest, projections of agricultural production and food processing to 1985 were made at that agency's request. The project was cooperative with the Marketing Economics Division of ERS. Agriculture is expected to continue a trend toward greater specialization and intensification in production. More irrigated land and clearing cutover forest areas will provide some expansion. Projected increases in the production of crops range from 50 percent for small grains to 140 percent for vegetables; 30 to 45 percent for hogs, and dairy and poultry products; and 175 percent for cattle and calves. An increase of about 85 percent in the processing of agricultural products is also expected to satisfy an increasing demand for highly finished food products without incurring transportation costs for inshipments. The increased production is expected to be accomplished with fewer farm workers on about 40 percent fewer, but larger, farms. Employment in processing plants is also expected to decline because of an average annual increase of 2 to 4 percent in output per worker.

A study of productive capacity and aggregate resource adjustments in U.S. agriculture, being conducted jointly with the Oklahoma Agricultural Experiment Station, indicates that production has exceeded utilization at acceptable prices from 5.3 to 11.2 percent since 1955, with a current

excess of slightly over 7 percent. Estimates of production elasticities for specified input categories have been derived from least-square adjustment models. Modifications were made in the adjustment models to permit ascertainment of changes in productivity of the various resource groups, as well as estimating rates of adjustment toward more optimum resource use. A paper presenting the results of this phase of the work is under review.

Further analysis of the implications of these findings is being conducted through the use of an aggregate production function of the Cobb-Douglas type. The production function utilizes the elasticity estimates obtained earlier with specific objectives being to determine (1) profit maximizing levels of inputs and output, (2) maximum output from given expenditures on selected inputs, (3) input changes needed to adjust for overcapacity, (4) changes in input substitution relationships, (5) factor-demand and product-supply elasticities, and (6) marginal productivity of inputs. A paper presenting these results is being completed.

B. Appraisal of Production Response and Needs for Adjustment

A project was initiated to develop, test, and apply a national model for production adjustment research and policy guidance. The purpose of this project is to provide timely estimates of farmers' production response to changes in prices, costs, Government programs, technology, and other factors. Emphasis is on providing aggregate and predictive estimates pertaining to major farm commodities for use as quantitative aids to judgment. Policy applications will involve determining the most likely short-term and intermediate-term changes in production, resource use, income, and interregional competition. About 80 farming situations in 45 geographic regions have been delineated for the first phase of the project. Much of the data for a test of the model and its initial applications have been compiled in Washington and at field stations.

A study of production response in the San Joaquin Valley of California has been completed and the results reported in a forthcoming USDA Technical Bulletin "Predicting Regional Crop Production--An Application of Recursive Programming." This study compares the results of alternative methods used to predict year-to-year changes in aggregate crop production.

Work was continued on an analysis of production response to alternative prices and Government commodity programs on farms in the Southern Coastal Plains. Data from the Farm Costs and Returns series for peanut-cotton farms are utilized in this study. An attempt is being made to simulate the production behavior of farmers in the Coastal Plains, and a procedure is being developed for grouping farms so as to minimize errors of aggregation.

Work was initiated on an analysis of production response in the Wisconsin-Minnesota Lake States region under a research contract with the University of Wisconsin for a study to develop an improved econometric

model for explaining aggregate production response. The objective is to refine recent methods of analysis and to test the effects of these refinements with emphasis on recognizing firm-household relations and other variables affecting response.

C. Appraisal of Adjustments in Dairy Areas

Work continued on the northeast dairy adjustment study, with active cooperation of 10 States. A workable linear programming model for the northeast was developed and perfected. Each of the production activities being considered was budgeted for each of the 20 areas in the region. Early testing of the linear programming models indicated aggregation bias in final supply functions. One source of bias was reduced by reclassifying and regrouping the farms. Another source was reduced by incorporating restrictive features into the linear programming models themselves. Restrictions included winter labor, farm building capacity (present building plus expansion possible through real estate credit), and cropland. One of the study areas (located in New Hampshire) having 51 sample farms, was used as a laboratory for more intensive study of aggregation bias. Each of the sample farms was budgeted through a wide range of milk prices. Then the farms were sorted and combined in different ways to isolate sources of bias. The knowledge gained has been used in reshaping the study in other areas.

The dairy production industry of Pennsylvania was classified into 5 geographic areas, each one relatively homogenous as to natural resources, market opportunities, and alternative crop and livestock enterprises. Each area is to be represented in the study by 9 farms stratified as to size (crop acres), type (dairy vs. non-dairy) and size of dairy herd. Each study farm was linear programmed to determine the optimum organization of resources and enterprises and derive the milk supply function. It was reprogrammed at various milk prices and at average and above average management efficiency. An excellent Ph.D. thesis "Selection of Representative Benchmark Farms in Synthetic Supply Estimation" has resulted from the study.

In southeastern Pennsylvania the adjustment opportunities of 15 farms representing common resource situations were studied in detail over a period of 6 years (1957-62). Case studies are being made on each farm to show changes and adjustments made during the six years, including changes in production, income and expenses. The most common adjustment was increased volume of business by expanding the dairy herd. On the average, the herd size increased a third during the period, sales of milk were 63 percent greater, sales per cow were 22 percent greater. Three of the original farm operators quit farming and one moved to another, different type of farm.

Adjustments that would be profitable in dairy farming in southeastern Minnesota are under study. Analysis of 330 sample dairy farms and their records for 1959, 1961, 1962, and 1963 indicates that Grade A dairymen are stronger competitively than Grade B producers because their production costs are similar and the larger volume of typical Grade A producers plus the price premium of $0.25 to $0.40 for Grade A milk give Grade B producers a strong competitive advantage. Two-man dairy farms with modern loose housing -- parlor dairy technology and milking from 65 to 80 cows appear to be in the strongest competitive position of any of the several producer strata studied. Within the Lake States the competitive advantage in dairying appears to be with those Grade A producers who have adequate capital to adopt modern technology but whose land resources are not well adapted to a highly intensive row crop (corn-soybeans) rotation. Small, inadequately financed farms and farms with highly productive land adapted to intensive row crop production generally have better alternatives outside of dairy farming.

Another phase of the study was concerned with factors (variables) associated with change in milk production on individual farms. Knowledge of these factors would permit prediction of output response. It was found necessary to first divide the sample of dairy farms into: (1) those having substantial off-farm income, (2) those farms with older operators with less incentive to adjust, and (3) the main portion of the sample. The independent variables proving to be the most accurate predictors of changes in milk production are: (a) cropland acres and dairy herd size; (b) willingness to borrow funds--net worth and ratio of assets to liabilities are less important; (c) long-run expected milk prices--the short-run are not important; (d) age of operator and years he expects to continue farming; (e) family labor supply; and (f) work off the farm.

Profitable adjustments on Wisconsin dairy farms in response to changes in technology, milk prices, and consumption have been analyzed. Farms with above average production per cow had $100 higher gross, $84 higher expenses, 25 percent more investment, and 2,870 pounds more production per cow than farms with below average production per cow. But amount of labor used was about the same. Marginal costs of milk production averaged $1.94 per hundredweight as production per cow increased within the range of 90 to 140 hundredweight, indicating that increased output per cow would be profitable. Average total costs decreased $1.25 per cow within the range of 40-113 cows per herd, indicating little economy to increasing scale of enterprise. However, the larger volume of sales from the larger herds would increase the income of the operator. Smaller herds (40-50 cows) are able to use modern technology efficiently and to achieve the same levels of output per cow. Two publications have resulted from the study.

In Michigan the effect on milk production of shifting from the present "blended-price" system to a two-price system for pricing milk, was

analyzed for six farm situations. Results indicated that with a two-price plan a lower level of milk production would be most profitable but some milk in excess of market needs still would be produced. Farms with good alternatives to dairying would decrease milk production the most. Further expansion in herd size would be discouraged but not halted. Upward pressure on land prices would be increased. A manuscript reporting the results is being prepared.

D. Appraisal of Adjustments in Cotton Areas

During the year emphasis in cotton adjustment work has been given to the completion of aggregates of crop acreages and production, labor used, investment requirements and returns for all major areas of cotton production in the South and in California under specified product price relationships. In the South Central area, this has been completed for (1) the High Plains of Texas, (2) the Low Rolling Plains of Texas and Oklahoma, (3) the Blacklands, (4) the Coastal Prairie, (5) the Coastal Bend, (6) and the Rio Grande Valley, all of Texas, (7) the Mississippi River Delta of Arkansas, Louisiana, Mississippi and Missouri and the Red River Delta of Louisiana, and (8) Northeast Arkansas. Similar aggregates were developed for the Brown Loam Area of Mississippi and the Central Louisiana Mixed Farming Area but on a less intensive basis of study.

In addition to the aggregates developed for the five specified price levels for cotton, optimum organizations were derived and aggregates developed for intermediate prices between a national price of 20 and 25 cents per pound for cotton for all areas except Central Louisiana. This was done because the bulk of the supply response for cotton occurred between these two price levels. These and the aggregates mentioned above are now under analysis at area and regional levels. An illustration of the results from intermediate pricing of cotton are shown in the following table.

At a national cotton price of 20 cents per pound, less than 25 percent of the Delta's potential cotton acreage is devoted to cotton. An increase of 3 cents per pound raises this proportion to 44 percent; 4 cents to 68 percent; and at the base price of 25 cents, to 75 percent of the potential acreage.

Some preliminary programming of the influence of alternative price-allotment levels on farm organization and income has been done for the High Plains of Texas, the Low Rolling Plains of Oklahoma, and the Delta.

In the Southeastern States the initial study areas, where cotton is a major crop, have been programmed, and estimates made of the optimum aggregate acreages and production for different cotton prices with assumed prices of other commodities. These estimates indicate that under the assumed conditions, in several areas of the Southeast such as the Brown Loam Area of west Tennessee, the Limestone Valley Area of Alabama and

Acreage aggregates, advanced technology, projected farm size weights, with cotton prices 20 and 25 cents per pound, Delta areas of Arkansas, Louisiana, Mississippi, and Missouri, and Red River Delta of Louisiana

National cotton price	Cotton 1/	Corn	Soybeans	Rice	Fallow	Hogs 2/	Total cropland
Cents per pound	Acres (1,000)	Acres (1,000)	Acres (1,000)	Acres (1,000)	Acres (1,000)	Acres (1,000)	Acres (1,000)
20	1,091	1,814	4,082	194	97	205	7,487
21	1,501	1,285	3,926	396	198	181	7,487
22	1,861	963	3,946	422	211	84	7,487
23	1,991	854	3,967	422	211	42	7,487
24	3,100	244	3,052	700	350	41	7,487
25	3,396	11	3,095	654	327	4	7,487

1/ Area's maximum potential cotton acreage 4,500,000.

2/ Acres of cropland pasture used by hogs.

the Coastal Plain Areas of Georgia and South Carolina, cotton would remain a major crop at a price of 25 cents per pound and in some situations would be competitive with other crops at 20 cents per pound. The estimates also indicate that, at lower cotton prices, acreages of feed grains, soybeans and forage crops would be increased.

Preliminary results from estimates of minimum resources required for specified levels of income indicate the need for much larger farms to meet minimum income levels of $3,500 and $5,000 for a large segment of farms in the Southeast.

Preliminary aggregations of cotton acreage, yield and production for the study areas, under the conditions assumed for the regional study, are shown in the following table.

A brief statement of the major assumptions may be helpful.

No acreage allotments were assumed to be in effect. But appropriate agronomic limitations were established for cotton, tobacco, peanuts, and total row cropland in each study area.

It was assumed that advanced technology, that is, improved production practices, would be used for all enterprises where profitable.

Results of linear programming of representative farm resource situations were weighted by the projected number of farms and/or resources in each situation to arrive at area aggregates. The area aggregates were added to arrive at national aggregations.

The results of the individual farm resource situation represent what would be the optimum or most profitable under the assumed conditions and not an estimate of what farmers would do.

Assumed prices of major products were: corn $1.10, wheat $1.25, soybeans $2.00 per bushel, peanuts $160 per ton, flue-cured tobacco 44 cents per pound, hogs $14.50 per cwt., and all cattle $12.00 per cwt. These prices were assumed to be U.S. averages. They were adjusted for area and quality differences. Assumed U.S. cotton prices were 15, 20, 21, 22, 23, 24, 25, 30 and 35 cents per pound of lint.

Prices paid for items used in production, except labor, approximated those prevailing in 1958 and 1959. This would represent an index of about 265 (1910-14=100). The index of wage rates was assumed to be 625 with 1910-14 as 100.

Historical data for 1962, 1953 and 1949 are shown for comparison.

Cotton acreage, yields and production under certain assumed conditions and with specified cotton prices, with historical comparisons

Assumed cotton prices	Study areas			United States		
	Planted acreage	Yields per acre	Pro-duc-tion	Planted acreage	Yields per acre	Pro-duc-tion 1/
Cents per pound	Million acres	Pounds	Million bales	Million acres	Pounds	Million bales
15	2.1	369	1.6	---	---	1.9
20	8.6	544	9.8	---	---	12.0
21	12.2	593	15.1	---	---	18.5
22	15.1	559	17.6	---	---	21.6
23	16.8	556	19.5	---	---	24.0
24	21.2	535	23.6	---	---	29.0
25	23.3	533	25.9	---	---	31.8
30	28.8	512	30.6	---	---	37.6
35	29.5	509	31.2	---	---	38.4
Year						
1962	13.4	432	12.1	16.3	438	14.9
1953	20.0	304	12.7	26.9	294	16.5
1949	21.7	284	12.9	28.3	274	16.1

1/ In 1962 the production from the study areas was 81.4 percent of total U. S. production. Total production for U. S., for assumed cotton prices, based on the 1962 relationship between study areas and U. S. total.

Data pertaining to returns to land, operators labor and management, and the acreage and production of other enterprises have been developed. Most data are available for each of 15 major cotton producing areas.

The figures in the table give a good indication of the effect of improved production practices on yields. They also give some indication of farmers' response to changes in product price relationships, although as indicated previously, the production figures represent what would be optimum under the assumed conditions and not estimates of what farmers would do.

The next phase of the study, which involves assumptions pertaining to several specified levels of acreage allotment-price combinations, is now underway in all study areas.

E. Appraisal of Adjustments in Wheat Areas

The studies on adjustments in wheat areas in the Plains and in the Pacific Northwest were reoriented to the needs of the cooperative regional projects, W-54 (revised) and GP-5 (new). The technical committees of these projects are developing equilibrium price-supply response models for the respective regions on the pattern of NC-54 in feed-livestock, and the Great Lakes and northeast dairy studies. The orientation of wheat adjustment studies requires a new delineation of adjustment areas and a redefinition of representative farms. Much of the previously developed input-output data can be used, but data on livestock enterprises are being developed.

In Kansas, work has continued on wheat adjustment area delineations, definition of representative farms, and revision of input-output data for the main crops. Analysis of the most profitable farm organizations with various prices for wheat and sorghum in northwest Kansas is nearly complete and will be incorporated in a report. A manuscript "Farm Machinery Costs by Size of Farm and Size of Machine, Kansas and Colorado" was prepared for publication. An article "Linear Programming Applied to Cost Minimizing Farm Management Strategies" was accepted for publication by the *Journal of Farm Economics*. The studies on wheat adjustments in Kansas constitute a contributing project to the regional research projects.

The wheat producing area of eastern Colorado was divided into five subareas, based on crop yields and alternatives to wheat. Representative farm situations have been defined and input-output data are being developed for the main farm enterprises, which data will be used for programming most profitable adjustments. One report on an analysis of farm machinery costs was published. Two other manuscripts were prepared--one reporting specified machinery costs by size and type of machine, and one reporting estimated costs and returns for major crop enterprises in the eastern Colorado wheat area. Both are to be published. The study on wheat

adjustments in Colorado is a contribution to the W-54 and GP-5 regional research projects.

In Nebraska work was begun on a study cooperative with the agricultural experiment station, to be a contribution to the GP-5 regional research project.

In eastern South Dakota machinery data for 3,000 farms is being tabulated and analyzed for the purpose of developing farm requirements and input-output data for the several farm enterprises in the area. This supplements and complements other data assembled from ASCS records.

In southwestern North Dakota (west of Missouri River) a survey was made of 116 farmers and ranchers who had converted cropland to grass under the SCS Great Plains Conservation Program, authorized by P.L. 1021. Replies indicate that most farmers reseeded cropland to grass to increase and stabilize farm income through expansion of livestock. Seventy-nine percent thought the shift would increase their income and 92 percent thought it would stabilize their income.

In the Plains area of Montana, county data on wheat and barley yields from 1919 to 1961 are being used to develop projections to 1970 and beyond. Projections are needed for estimating production response of individual farms in connection with regional studies (GP-5 and W-54) and for national models of production response. Yield data are also being used to develop formulas to calculate crop insurance premium rates and coverages for a study of crop insurance.

In the three principal wheat producing areas of Montana an interview survey was made of small farms. Results indicate that about 50 percent of the small-farm operators have off-farm employment; the majority of them are the younger farmers. Nonfarm sources provided about half the average net income of operators of 240 acre farms, and about a third on the 480 acre farms. In dryland wheat farming these are small farms; a full-time farm has about 800 acres of cropland. Model farms are being constructed in the 240-acre and 480-classes as an aid in appraising the impact of current farm programs and other possible programs upon these farm firms.

In the Columbia Basin of Oregon, detailed production-income budgets for the beef-raising enterprise were developed for eight representative wheat-livestock farms. The size of breeding herds was found to be closely associated with noncropland acres. Amount of cropland did not affect herd size but did influence the extent of beef fattening and the costs of production. Average returns to land, labor, and management ranged from $46 per breeding cow for the small cattle enterprises to $35 per head for the large enterprises. These results do not necessarily reflect the comparative efficiencies of large and small herds because neither the cost of homegrown feeds nor a charge for operator and family labor was included

in the costs. Data from the study will be developed and used for a production response programming model.

In Idaho work has continued on developing data to describe, understand, and define the population of farms. The data include information on cropland use as found in ASCS records, and replies to a mailed questionnaire to one-fifth of the wheat farm operators listed on ASCS rolls.

For the annual cropping areas of eastern Washington, budgets for 16 crop rotations and budgets for hogs, beef and sheep production have been prepared for three sizes of wheat farms. These data aid the analysis of production adjustments and supply response in the area. In one programming model, lands of different quality are considered making it possible to appraise the effect of retiring to noncrop use only the sub-marginal lands.

F. Appraisal of Adjustments in Rice Areas

In studies of adjustments in rice areas emphasis has been given to (1) refinement of forage yields for pastures and the determination of optimum rice-pasture-beef cattle rotations and (2) to aggregation of programmed optimum organizations. Aggregates of crop acreages and livestock numbers, crop and livestock production, labor, investment requirements and returns have been developed at 5 price levels for rice and other crops at base for the Grand Prairie and northeast Arkansas and for the Delta rice areas of Arkansas, Louisiana, and Mississippi. Rice enters into the production of these areas at $2.33 per hundredweight. However, it would take a price of $4.22 per hundredweight for rice to reach the maximum potential acreage in all areas. The major changes in rice production occur between prices of $2.95 to $3.05. Additional aggregates were developed with varying prices for soybeans and cotton.

In the old rice area of Louisiana and the Texas Gulf Coast, where livestock introduces a complicating factor, progress has been a little slower. However, programmed optimums have been derived for the resource situations in these areas and aggregation has been started.

G. Appraisal of Adjustments in Feed-Livestock Areas

A regional study of feed grains, beef and hogs within and bordering the Corn Belt was described in last year's report. Field survey work and much of the analysis of representative farms has been completed. Profit maximizing farm organizations were computed for each combination of prices (adjusted for locality) as follows:

	Low	Medium	High
Corn (U.S. season av.)	$ .80	$1.00	$1.20
Hogs (Chicago, season av. barrows and gilts)	$11.84	$14.80	$17.76
Beef (Chicago, season av. choice slaughter steers)	$16.64	$20.80	$24.96

Although results differ somewhat among resource situations, profit maximizing adjustments tend to be similar for many representative farms. At medium and high prices, hog production would increase substantially and would dominate the livestock on many farms. An expansion of beef feeding would be profitable only at the highest price level ($24.96). At the lowest beef and hog prices and the highest cow price, a substantial amount of corn would profitably be produced for sale. The most profitable crop rotations maximize production of row crops (corn and soybeans), and produce only enough roughage for livestock use. Earnings on capital and labor are higher in corn and soybeans than in livestock production and fattening, a finding consistent with current adjustments going on in the Corn Belt. Type of farm (whether livestock, cash-grain, or dairy, for example) has little effect on optimum farm organization. Some dairying would be profitable only at low hog and beef prices, and then only on farms with dairy facilities already available.

Examples of the profit-maximizing plans, with and without land purchase, are presented for livestock farms in Minnesota, as follows:

	Small farms		Medium farms		Large farms	
	Without purchase	With purchase	Without purchase	With purchase	Without purchase	With purchase
Corn, acres	61	96	86	123	170	226
Soybeans, acres	48	76	75	91	126	154
Wheat, acres	0	0	0	15	0	15
Hay, acres	11	17	16	23	30	39
All cropland, acres	128	202	185	265	339	452
Fed cattle, no.	34	67	32	83	59	122
Sows farrowed, no.	79	54	105	69	185	143
Corn bought, cwt.	2,535	0	2,617	0	3,695	0
Land bought, acres	0	89	0	94	0	134
Income over operating exp., dol.	12,340	13,900	17,150	18,750	31,310	33,290

Current farm size, and the capital base it represents, is an important determinant of optimum farm organization. Major increases in livestock that would be profitable, require much additional capital ($35,000 to $50,000 in many cases) and can be financed only with substantial real estate assets. Capital and credit effectively limit livestock expansion on many small and medium-sized farms. On large farms it is labor which most often limits livestock expansion that otherwise would be profitable.

In Nebraska it was found that native pasture would be used by calves under a deferred feeding program whenever price relationships would favor beef-feeding over raising hogs. A beef cow-calf enterprise did not appear in any profit-maximizing programs, which implies considerable adjustment for eastern Nebraska farms on which a small beef cow herd is common. Procedures for aggregating the results from programming individual farms are being developed including tests for sample size and for aggregation bias.

Analysis of economic adjustments to changing prices in west-central Ohio has been completed for 160-acre farms. The most significant adjustment was an increase in size. It was also the most profitable. Actual adjustments made on the farms in a 5-year period were correlated with 25 independent factors thought to be associated with adjustments. The statistically significant relationships isolated for each type of adjustment were as follows:

Total farm adjustments were significantly influenced by amount of capital available, amount of reinvestment, and amount of current cash costs of farming.

Crop adjustments depended more on operator's debt position and ratio of cash costs to productive-man-work-units.

Livestock adjustments varied with the capital position of the operator, the change in hog and corn prices from the previous year, and the age and education of the operator.

Technological adjustments were influenced mainly by the capital position, a sustained rate of change in prices of livestock and livestock products, level of current cash costs, and the reinvestment policy of the operator.

Cost adjustments were associated simply and conversely with direct cash costs. The higher cash costs became, the more likely were adjustments to take place. Some changes in costs are, of course, due to other prime adjustments.

Improvement adjustments were related to the operator's capital equity position, his willingness to reinvest in his farm business, and the sheer cost of such major improvements as liming and fertilizing. There is some evidence that a younger operator with sufficient capital is more likely to make major improvements than an older operator with the same capital.

Capital use adjustments, such as major changes in either short-term or long-term debt pattern, were highly correlated with current level of cash costs and with amount of reinvestment the operator made.

Non-economic factors generally acted as only slight deterrents to adjustment. Operators thus influenced made fewer adjustments, but the difference was not statistically significant.

A study on selection of representative farms for aggregating adjustments is being initiated in cooperation with the Iowa Experiment Station. Representative farms are useful in simulating adjustment decisions of individual farmers, in restricting resource mobility between farms, and in disaggregating adjustments to farm situations. But the procedures are subject to bias. Data from the NC-54 cooperative regional project will be used to explore the relationship between possible bias and the number and manner of selection of representative farms. Aggregative estimates may be free of bias if all farms in a sub-population have the same enterprises as their optimum organizations as determined by programming. As the study has just begun, there are no reportable results.

An economic appraisal of regional adjustments in production and resource use to meet changing demand and technology is being made in cooperation with the Iowa Experiment Station. Average input-output coefficients in each of 157 regions for crops and 20 regions for livestock are used in a least-cost linear programming model. Interregional transfer costs of products are included in the analysis. Enterprises include feed grains, wheat, soybeans, cotton, hay, pasture, grain fattened cattle, other beef cattle, dairy cattle and hogs. Computations have been completed on the benchmark model of regional patterns of crop and livestock production. Preliminary analysis indicates that for a given demand level, adjustments are toward more regional intensification of hog production, somewhat less for cattle fattening.

Many of the largest feedlots in Arizona do custom feeding. A large percentage of the custom-fed cattle are owned by "professional" cattle feeders who feed 1,000 to 20,000 head annually, and make all or most of their income this way. Many are also cattle brokers who know how to make "good buys." Others who own custom-fed cattle are: (1) packers, (2) stock ranchers, (3) operators of small feedlots who "warm up" the cattle in their own lots and finish them in custom lots, and (4) persons having financial resources--bankers, lawyers, insurance agents, retired people, and so on--who regard cattle feeding as a profitable investment. Credit is universally used to finance the purchase of feeder cattle and to pay custom-feeding charges. Multiple regression analysis of 48 lots of cattle shows that a pound of digestible nutrients from concentrates (mostly grain) is far more efficient than forage in putting on a pound of liveweight gain. Arizona feedlots have substantially higher feed conversion ratios than do Corn Belt farms, explained partly because Arizona cattle are not finished to as heavy weights or as high a degree of finish.

This greater feeding efficiency tends to offset the higher price of feed as compared to the Corn Belt. Arizona feedlots also enjoy a wider price margin between feeder and finished cattle, largely because they buy more "Okies" and Brahma cross cattle which are regarded as lower quality in the older Corn Belt feeding area. However, when finished these cattle grade mostly choice. In the last 15 years, Arizona feedlots have shifted from a high forage to a high concentrate ration. They now feed younger cattle and put more gain on in the feedlot. Feeding efficiency has increased substantially.

In a study on economics of cattle feeding in the South Platte Valley of Colorado, data from a survey indicated that the number of cattle fed was closely related to acres of irrigated cropland on farms that fed less than 500 head of cattle annually, but not with larger establishments. Five hundred head represents the dividing line between farm feeders and specialized cattle feeders. Availability of neither family labor or regular hired workers was related to number of cattle fed among the farm feeders. Production and income budgets were developed for feedlots of different capacity. If all resources used in feeding are charged against the enterprise, the operating and fixed costs will exceed $70 per head for a lot with 135 head capacity compared to $30 for a lot with 15,000 head capacity. Normally it pays the small lots to have a feed processing mill, appropriate to the scale of feeding, and the investment can be recovered in less than ten years.

Feed costs per 100-pounds of gain in Nebraska are influenced more by the kind of cattle fed--calves, yearlings, two-year olds--than by size of operation. Non-feed costs are related to size of operation. Feed costs per 100-pounds gain are about 15 percent lower for calves than for yearlings. Non-feed costs are a third less per 100-pounds gain for large operations than for small operations. However, most of the economies of scale are achieved by operations of 275 to 400 head. Farm feeders who feed 275-400 head of calves are about as efficient as large operators who feed older and heavier cattle. Farm feeders can compete effectively with large commercial operations because the farm feeder can utilize some feeds having no market value and can use labor not otherwise employable. Labor efficiency in handling feeds and cattle is less important to the farm feeder.

Complementary relationships are not immediate and direct between irrigated farms on the Belle Fourche irrigation project and surrounding dryland farms and ranches in western South Dakota as might be expected. Although a majority of the 37 irrigated farmers and 34 dryland farmers surveyed believed that irrigation and dryland farming could be complementary, less than one out of ten have any business arrangements involving the two types of farming. In 1963 there was little movement of feed between irrigated and dryland farms. The irrigated farms sold less than 5 percent of their

alfalfa hay but sold 25 percent of the corn they raised, but it was not bought by the dryland operators.

Production problems and adjustments on range-livestock ranches are being studied in Oregon, California and Texas. In California, a field survey is being conducted to supplement the input-output data on hand and to complete the cross-section representation of livestock ranches. The sample includes mainly those sheep and cattle ranches that do not have public land grazing permits in five subareas of California. In addition, a sample of ranches with grazing permits is being surveyed in each of the ranching areas of the State which, for purposes of this study, were not adequately represented by the surveys for the grazing fee study completed for public land agencies. Ranching data and budgets will be exchanged with Oregon and Nevada for border areas having similar type ranching operations.

In Oregon the research effort has centered on the development of a framework for analysis, defining the population of ranches, and determining the necessary data. Cattle ranch operators in three southeastern Oregon counties were randomly selected for survey in a way that will allow aggregative checks with census reporting districts, and will allow the simultaneous use of time series and cross sectional analyses. The ranch survey data is presently being assembled for analysis. For a five-month period all cattle marketed through the Oregon auction markets were tabulated with respect to type, weight, and price received. Results tentatively indicate that significant differences may in fact exist within the price-class relationships as reported by the U.S. Crop and Livestock Reporting Service. For instance, the data suggest an inverse relationship between price and weight for calves within the price and weight range reported.

In a study of profitable adjustments in livestock ranching in Texas and adjoining areas in the Southern Great Plains, a sample of ranches has been drawn from ASCS records in the High Plains and Rolling Plains of Texas. Interviews were conducted with the operators and information on investment, management practices, input-output relationships, costs and income. Construction of representative ranch budgets is now underway. These will be used to determine optimum organizations under different levels of practices.

In a study of the economics of beef production in farming systems in the Mississippi Delta, results of a dynamic linear programming problem indicate that, in shifting from present to optimum organizations, row and sod crop adjustments can be completed in seven years or less. The beef enterprise continued to increase in size until year nine, growing as the new sod crops matured and increased in carrying capacity. Upon the completion of a report covering these results the project will be terminated.

A report "Economic Relationship of Grazing Fees and Permitted Use of Public Rangeland to the Net Income of Western Ranches" has been submitted for publication. It reports the results of a study that was requested by the Bureau of Land Management and the Forest Service. The study included 85 types and sizes of cattle and/or sheep ranches commonly found in eight ranching areas in the West. Production-income budgets demonstrated the effect on net ranch income of charging alternative grazing fees and privileges for the 1960 situation as to organization, investments, costs and prices. This study was reported in prior annual reports.

H. Appraisal of Agricultural Policies and Programs

An appraisal of the 1963 Pilot Cropland Conversion Program was made. This program was appraised as to its effect on agricultural production, the use of land and other resources and on farmers' incomes. The study included farm surveys in two or three counties in each of five areas--one area each in North Dakota, Iowa and Mississippi and two in Georgia. The pilot program operated in a total of 41 counties in 1963. Program participants in the five areas studied, on the average, converted 12 to 34 percent of their cropland to conserving uses. Most of the land in the program is under agreements for five years but some is in for ten years.

Farms in the pilot program were larger than other farms in their respective counties, they had more cropland, had as many or more acres of allotment crops and feed grain base, and had more livestock--mostly beef cattle. During 1963, the average acreage of all farms in the study areas continued to grow, but farms in the program grew faster than others. Likewise, the average number of livestock on all farms increased, but increased faster on farms in the program. In 1962, the year before the program, a third of the program land in Iowa had been in row crops and small grain, and four-fifths of it in Mississippi. Nearly all of the program land will be used for pasture while under agreements. And, except in Iowa, 80 percent or more of the land will remain in conserving use after the agreements expire.

Farmers in the pilot program were younger, had more education, and except in North Dakota, a slightly larger proportion of them had off-farm jobs in 1962. Participation in the program did not affect the number having off-farm jobs in 1963, which ranged from 19 percent in North Dakota to 71 percent in the Piedmont of Georgia. Less than 3 percent of the farmers in any area were looking for off-farm jobs. Incomes from off-farm sources were highest in Mississippi and Georgia. In the Georgia Piedmont area, two-thirds of the participants had annual incomes from off-farm sources of $2,000 or more and a third had $5,000 or more.

In a study of the 1962 Feed Grain Program, the profitability of participation versus nonparticipation was estimated for each sample farm, both

participants and nonparticipants. Preliminary results indicate that participation was more profitable than nonparticipation would have been for 54 percent of the participants in the Corn Belt and 68 percent of them in the grain sorghum area of the Southern Great Plains. Participation would also have been profitable for 84 percent of the nonparticipants in the Corn Belt and 96 percent in the Southern Great Plains. Profitability of the two situations was based on returns above variable cash costs. The assumed market prices ranged from 13 to 22 cents per bushel below support prices for corn in the Corn Belt and about 28 cents per cwt. below support prices for grain sorghum in the Southern Great Plains. It was further assumed that nonparticipants, if they had participated, would have diverted the minimum acreage required for eligibility (20 percent of their feed grain bases). Minimum diversion would have been the most profitable because diversion payments frequently were less than the value of the crop minus variable cash costs. Participants diverted an average of 33 percent in the Corn Belt and 30 percent in the Southern Great Plains.

In a study of interregional adjustments through land retirement, cooperative with the Iowa Agricultural Experiment Station, interregional linear programming models were used to study the effect of alternative land retirement programs that might be considered. The models included 144 spatially separated producing regions representing about 95 percent of U.S. production of wheat, feed grains, cotton, and soybeans. It also included 31 spatially separated consuming regions for these commodities. The objective was to determine the location of production at least total cost, and the amount and location of farm land that would not be needed for farming under each plan of allocation. The projections are to the year 1965. Seventeen solutions were obtained from three different models. The programs assumed ranged from free markets to mandatory retirement of wheat and feed grain land. Also considered were alternative pricing schemes for wheat and alternative price levels for all farm products. In one model, land was differentiated as to quality so as to estimate the effect of retiring land at the margin in each region in contrast to models that assume average land productivity. Two manuscripts reporting the results are in process.

PUBLICATIONS--USDA AND COOPERATIVE PROGRAMS

A. National and Regional Productivity in Agriculture

Egbert, A. C. and Heady, E. O. 1963. Regional analysis of production adjustments in the major field crops: historical and perspective. Tech. Bul. 1294. 67 pp.

Farm Production Economics Division. 1964. Changes in farm production and efficiency. Stat. Bul. 233 (revised). 50 pp.

Farm Production Economics Division. 1964. Changes in farm production and efficiency; supplement 1. Farm production, by groups of livestock and crops, for each production region, 1939-63. Stat. Bul. 233. 12 pp.

Poli, A. 1963. Long-term production prospects for western agriculture. AER-33, supp. 20 pp.

Shaw, Lawrence H. and Durost, Donald D. 1964. The weather index approach. Chapter in Weather and Our Food Supply. Iowa Agr. Expt. Sta. CAED Rpt. No. 20, pp. 93-103.

Shaw, Lawrence H. 1964. The effect of weather on agricultural output: a look at methodology. Jour. Farm Econ. 46(1), pp. 218-230.

Shaw, Lawrence H. 1964. The Wallis-Moore nonparametric statistical test. Jour. Farm Econ. 46(1), pp. 249-250

Tyner, F. H. and Tweeten, L. G. Excess capacity in U.S. agriculture. Agr. Econ. Res. 16(1), pp. 23-31.

B. Appraisal of Production Response and Needs for Adjustment

Day, Richard H. 1963. On aggregating linear programming models of production. Jour. Farm Econ. 45(4), pp. 797-813.

Day, D. H. 1963. Simple methods of estimating certain nonlinear functions with emphasis on agricultural data. Agr. Handbook 256. 28 pp.

Schaller, W. Neill. 1964. Data requirements for new research models. Paper presented at Annual Meeting, Amer. Farm Econ. Assn., Purdue Univ., Aug. 17-19.

C. Appraisal of Adjustments in Dairy Areas

Barker, Randolph. 1964. Use of linear programming in making farm management decisions. N. Y. Agr. Expt. Sta. Bul. 993, 43 pp.

Bird, A. R. 1963. Least cost organization of Massachusetts dairy farms for four levels of gross income. Mass. Agr. Expt. Sta. Pub. 539. 32 pp.

Irwin, George D. 1963. How dairying has fared in Michigan. Mich. Farm Econ. No. 249.

Irwin, George D. and Rhoade, R. R. 1964. Higher profit plans for farms with dairying potential. Mich. Agr. Ext. Res. Rpt. 5. 8 pp.

Irwin, George D. and Bonnen, J. T. 1963. Can Michigan dairymen compete? Mich. Farm Econ. No. 250.

Kimball, N. D. and Peterson, G. A. 1964. New facilities for larger dairy herd. Wis. Agr. Expt. Sta. Cir., Vol. 30, No. 1. 4 pp.

Kimball, N. D. and Peterson, G. A. 1964. Economic evaluation of alternatives for developing large dairy farms in Wisconsin. Wis. Agr. Expt. Sta. Bul. 571. 38 pp.

Pedersen, Ronald W. 1964. Possibilities of intensification on a clay-and-till dairy farm, north country region, New York. N. Y. Agr. Expt. Sta. Bul. 991.

Sundquist, W. B. 1964. Income-improving adjustments in Lake States dairying. Minn. Farm Business Notes No. 462.

Sundquist, W. B., Bonnen, J. T., McKee, D. E., Baker, C. B., and Day, L. M. 1963. Equilibrium analysis of income-improving adjustments on farms in the Lake States dairy region. Minn. Agr. Expt. Sta. Tech. Bul. 246. 54 pp.

Sundquist, W. B. and Holt, James. 1964. Income-improving alternatives on grade A dairy farms in Minnesota. Minn. Agr. Expt. Sta. Bul. 473.

D. Appraisal of Adjustments in Cotton Areas

Bolton, Bill. 1964. Variable resource programming for appraising farm adjustment opportunities. Agr. Econ. Res. 16(1), pp. 12-22.

Crowe, Grady B. 1964. Changes in technology as they affect cotton production costs. Proceedings 1964 Beltwide Cotton Production-Mechanization Conference, National Cotton Council, pp. 5-6.

Crowe, Grady B. 1964. Advanced technology and what it means to efficient cotton production. Paper presented before the Anniversary Meeting of the American Cotton Congress.

Goodwin, J. W., Plaxico, J. S. and Lagrone, W. F. 1963. Aggregation of normative microsupply relationships for dryland crop farms in the Rolling Plains of Oklahoma and Texas. Okla. Agr. Expt. Sta. TB T-103. 69 pp.

Hall, H. H., Connor, L. J., Walker, O. L. and Lagrone, W. F. 1963. Resource requirements, costs, and expected returns; alternative crop and livestock enterprises; Oklahoma Panhandle. Okla. Agr. Expt. Sta. Proc. Ser. P-459. 58 pp.

Hatch, Roy E., Tefertiller, K. R., Moore, D. S. and Rogers, Ralph H. 1964. Production and production requirements, costs and expected returns--cotton, grain sorghum and major fresh market vegetable crops on clay soils-Lower Rio Grande Valley of Texas. Texas Agr. Expt. Sta. MP-694. 51 pp.

Hatch, Roy E. and Moore, D. S. 1964. Production and production requirements, costs and expected returns--cotton, grain sorghum and major fresh market vegetable crops on loam soils--Lower Rio Grande Valley. Texas Agr. Expt. Sta. MP-719. 59 pp.

Martin, J. R., Lagrone, W. F., Plaxico, J. S. and Connor, L. J. 1964. Effect of changes in product price relationships on farm organizations and income--clay soils farm--southwestern Oklahoma. Okla. Agr. Expt. Sta. Bul. 621. 24 pp.

Martin, J. R., Lagrone, W. F. and Plaxico, J. S. 1964. Effect of product prices on farm organization and income--sandyland farms--southwestern Oklahoma. Okla. Agr. Expt. Sta. Bul. 625. 22 pp.

McArthur, W. C., Saunders, F. B. and Fortson, J. C. 1964. Optimum organizations for general crop and crop-livestock farms, southwest coastal plain area, Georgia. Ga. Agr. Expt. Sta. Bul. N.S. 118. 29 pp.

Moore, D. S., Tefertiller, K. R., Hughes, W. F. and Rogers, R. H. 1964. Production and production requirements, costs and expected returns for crop enterprises--medium-textured (mixed) soils--High Plains of Texas. Texas Agr. Expt. Sta. MP-695. 74 pp.

Partenheimer, Earl J. and Strickland, P. L., Jr. Optimum farm organization and aggregate area production, wiregrass area of Alabama. Agr. Expt. Sta. of Auburn Univ. Agr. Econ. Series 3, 1964. 100 pp.

Reichardt, A. W., Lagrone, W. F., and Tweeten, L. G. 1964. Resource requirements, costs and expected returns; alternative crop and livestock enterprises; major bottomland soils of East Central and South Central Oklahoma. Okla. Agr. Expt. Sta. Proc. Ser. P-476. 51 pp.

E. Appraisal of Adjustments in Wheat Areas

Anderson, J. C. 1964. A supply response study: methodology and practical considerations. Western Farm Econ. Assn. Annual Proceedings (1963), pp. 96-101.

Krenz, R. D. 1963. How many farms in North Dakota in year 1975? In year 2000? N. D. Farm Res., 23 (1), pp. 19-22.

Krenz, R. D. 1964. Planning production with voluntary diversion programs. N. D. Agr. Expt. Sta. Bul. 449. 16 pp.

Krenz, R. D. 1964. Projection of farm numbers for North Dakota with Markov chains. Agr. Econ. Res. 16 (3), pp. 77-83.

Krenz, R. D. 1964. Paired comparisons as applied to seeding cropland to grass. Paper presented at Annual Meeting, Amer. Farm Econ. Assn., Purdue Univ., Aug. 17-19.

Sitler, Harry G. 1964. Costs of farm machinery on eastern Colorado wheat farms. Colo. Agr. Expt. Sta. Bul. 521-S. 32 pp.

F. Appraisal of Adjustments in Rice Areas

Grant, W. R. and Mullins, Troy. 1964. An economic appraisal of enterprise adjustments on rice farms. The Rice Jour. 67(7), p. 21.

Grant, W. R., and Mullins, Troy. 1963. Enterprise costs and returns on rice farms in the northeast Arkansas rice area. Ark. Agr. Expt. Sta. Rpt. 125. 66 pp.

Hall, V., Bryan, Billy, Engler, Kyle, Grant, W. R. and Mullins, Troy. 1963. Plastic levees in rice irrigation. The Rice Jour. 66(13), pp. 8-9.

Mullins, Troy. 1964. Some effects of advanced technology and of prices received on adjustments in resource use on rice farms. Paper presented at the biennial meeting of the Rice Technical Working Group.

G. Appraisal of Adjustments in Feed-Livestock Areas

Cornelius, G. L. 1964. Comparison of alternative beef cattle systems for western South Dakota ranches. S. D. Agr. Expt. Sta., Agr. Econ. Pam. 117. 20 pp.

Egbert, Alvin C., Heady, Earl O. and Brokken, Ray. 1964. Regional changes in grain production--an application of linear programming. Iowa Agr. Expt. Sta. Res. Bul. 521. pp. 983-1016.

Hunter, Elmer C. 1963. Coordinated livestock marketing as an integrated operation. American Cooperation, 1963.

Hunter, Elmer C. 1963. Changing beef production patterns in the United States. Paper presented at American Society of Agronomists, Denver, Colo., Nov. 20, 1963. Published in Western Livestock Jour., Jan. 1964, pp. 26-34.

McCorkle, C. O., Murphy, A. H., Rader, Lynn, and Caton, D. D. 1964. Cost of tree removal through chemicals. Jour. Range Mgmt., Sept. 1964.

Pawson, Walter W. 1964. Emerging patterns of feedlot management in the southwest, and interregional competition in the location of cattle feeding. Proc., Cattle Feeding Research Workshop, Denver, Colo., Mar. 16-18, 1964.

Sharples, J. A. and Tompkin, J. R. 1963. The effect of the 1961 feed grain program on west central Ohio farms. Ohio Agr. Expt. Sta. Bul. 947. 28 pp.

Tompkin, J. R. and Rafeld, J. F. 1964. Economic evaluation of actual and optimal adjustments in resource use on 160-acre farms in west central Ohio, 1956-1959. Ohio Agr. Exp. Sta. Res. Bul. 965. 65 pp.

Boykin, Calvin C. 1964. Cattle ranch adjustments to drought in the Southern Plains. Texas Agr. Expt. Sta., Departmental Information Rpt. 64-2.

H. Appraisal of Agricultural Policies and Programs

Butcher, W. R., Heady, E. O. and Rigler, L. G. 1964. The conservation reserve in south-central Iowa. Iowa Agr. Expt. Sta. Res. Bul. 525. pp. 70-88.

Whittlesey, Norman K. and Heady, Earl O. 1964. Linear programming models applied to interregional competition and policy choices of U.S. agriculture. Proc. of winter meeting (1963), Econometric Society.

AREA NO. 2. ECONOMICS OF FARM MANAGEMENT AND CONSERVATION PRACTICES

Problem. There are marked differences among the major agricultural areas in the physical and economic environment which determine the possibilities and limitations on successful operation of farms. More information is needed for each type of farming region on the patterns of production resources and systems of farming used by individual farmers; the production requirements and output obtained from various enterprises with different methods of operation, including especially those practices that aid in soil and water conservation; the relationships between size of operations, combination of enterprises, production practices used, efficiency in production, and farm financial returns; and alternative opportunities for desirable adjustments, particularly those which conserve soil and water, on farms of different sizes, types and physical conditions.

USDA AND COOPERATIVE PROGRAM

A continuing long-term program of research dealing with the economics of farm management practices is conducted in cooperation with 12 State experiment stations. In the northeast region, emphasis is on input-output relationships for dairy forage and poultry. In the Corn Belt, research emphasizes hog production and corn harvesting. In the southern region, emphasis is on mechanization and various patterns of skip-row planting of cotton, and in the western region attention is given to mechanization. Studies of the economics of conservation practices are emphasized in Wisconsin, Missouri, and Texas. While major attention is given to determining input-output relationships, emphasis is also given to economic analysis within the framework of profitability to the farm firm.

A total of 7.1 Federal professional man-years was devoted to this area of research--3.3 man-years in economics of farm management practices, 3.5 in economics of conservation practices; and 0.3 in program leadership.

PROGRAM OF STATE EXPERIMENT STATIONS

Differences in climate, topography, soil-type, crops grown, distance to market, etc., result in many types of farms and farming systems, each of which requires specific studies. Fifty-nine studies fall within the broad category of farm organization, adjustments, and operations. Both fundamental and applied research is being conducted. Studies of optimal adjustments in farm organization and managerial skills and performance constitute one of the larger areas of needed research. Six studies contribute to regional project NC-59, The Identification and Measurement of Management Ability and Its Effect On Resource Use in Farming. This study is concerned with some of the basic processes in decision-making.

Regional project W-16, Economics of Range Resource Use, a broad study of range management, is being concluded. Conservation has been upward in the minds of the farmer and public alike for some time but to obtain a short-run high net income and at the same time conserve the soil has been no easy task. However, effective research is being done. For example, in a study conducted by the Department of Agricultural Economics at the Iowa Station, in cooperation with the Department of Agronomy, soil-conserving systems were developed that would result in an increase in net income of $1,740 over the existing systems. Through comprehensive analysis of alternative farm organizations and practices a number of technological innovations were made economically feasible. The optimum use of each resource, considering all possible enterprise combinations and practices, was determined. Likewise, the net gain from the use of additional capital was established. A total of 38.5 professional man-years are devoted to this area of work.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Economics of Farm Management Practices

A New Hampshire dairy forage harvesting study appraised the effect of different machinery systems of forage harvesting, different weather patterns, and different harvesting dates on the quantity and quality of forage produced, and hence on income of a 100 crop acre farm. Solutions were programmed for different assumed situations as to number of cows (50, 75, and 100), buying and selling of hay, and dates that forage harvesting would begin (June 1, June 15, and June 30). Early harvested hay usually is higher in quality because usually it contains more protein but it yields less per acre. One method of harvest requires more than one day to dry the forage for safe storage. Another, more expensive method dries the forage in one day. The analysis was based on actual weather patterns for 52 years.

The relationship between date of forage harvest and net income for different land-cow ratios were as follows:

Starting date	Average net farm income	Percent change from June 1
	Cropland/cow ratio 2.0 to 1	
June 1	$9,160	---
June 15	9,810	7.1
June 30	9,800	6.9
	Cropland/cow ratio 1.5 to 1	
June 1	$12,600	---
June 15	12,780	1.6
June 30	12,000	-4.7

Cropland/cow ratio 1.0 to 1

June 1	$15,200	---
June 15	15,120	-.6
June 30	13,510	-11.2

Cropland/cow ratio variable to consume all grown forage

June 1	$12,880	---
June 15	15,050	16.8
June 30	14,171	9.9

These results indicate that it is more profitable to cut hay early when land use is intensified by increasing the number of cows on a given acreage of land. With fewer cows (one per 2 acres of land) a later harvest date--June 15 or June 30--is more profitable. For a given cow-land ratio, the date of harvest may affect net income as much as 20 percent. But a larger change is associated with a change in herd size. That is, it is more critical to have the optimum number of cows than to select the optimum forage harvesting date.

A market egg study in Connecticut investigated the egg processing alternatives open to commercial producers. The two main alternatives are: (1) the predominant practice of sizing and packing clean eggs in case lots, and (2) the packing of clean unsized eggs in cases. In the first category, three systems were considered that differ in labor and capital requirements per unit of output. The common system of washing eggs in an immersion type washer and grading eggs with a 10-case per hour grader required 23 minutes of labor per case and an equipment outlay of $940. A system with an in-line washer that is coordinated with the egg grader reduced labor requirements about 13 minutes per case, but outlays for equipment totaled $1,965. Egg farms with three or more workers can employ higher volume equipment. More than $7,400 would be required for processing equipment, but labor would be reduced substantially requiring about 9.5 minutes per case. In the second category, egg sizing is not done on the farm, and labor requirements and equipment outlays are lower. But a lower quality product is sold and returns per dozen eggs are lower. Two methods of selling unsized eggs were considered. One situation, requiring a capital investment of $350 for egg room equipment, takes approximately 17.5 minutes of labor per case of eggs. The second system costs $6,000 to install, but requires only about 12.5 man minutes per case.

Records for 1962 and 1963 from about 150 farmers each in southeastern and southwestern Minnesota were summarized. Returns per $100 of feed costs were lower in 1962 than in the previous 5 years, due largely to the decline in fed cattle prices. With the further price decline in 1963, many feeders failed to cover feed costs by about $3 and $6 (per $100 of feed costs) in each area respectively. No income remained to cover such costs

as labor, power, equipment and buildings. The trend toward larger and more specialized farms continued, with an increase in the size of livestock enterprises and a decrease in farms with poultry enterprises. From 1955-59 to 1962 the farms having poultry decreased from 59 to 28 percent. During the same period gross farm receipts increased from about $22,000 to $26,700 per farm, reflecting an increase in volume of business.

In a study of alternative systems of hog production in Illinois, two reports were prepared during the year. One, "Some Adjustment Made by Early Adopters of Confinement Production of Hogs," examines the problems and changes that have been made by the early adopters of confinement between 1959 and 1963. Confinement facilities are expensive--some $20 to $30 of investment per head produced per year--and they are permanent, lending themselves to change only with difficulty. This report notes several farms discontinuing production with many inefficiencies continuing on farms that continue to operate. Adoption of new equipment has been more rapid.

The second report, "Processing and Distribution of Feeds for Hogs Produced in Confinement," presents an economic evaluation of custom processing of feeds, and selected methods of farm-owned mobile and stationary feed processing and distribution equipment for enterprises ranging from 50 to 2,500 tons of feed handled annually--approximately 100 to 5,000 hogs. Results show specific advantages and disadvantages of each method. Custom processing is competitive or less costly than other methods for handling volumes of less than 100 tons of feed annually. Above this volume the cost advantage of on-farm systems increases as costs per ton drop rapidly from $3.50 to $4.00 at 100 tons to about $1.50 at 400 tons. Costs decline to $1.00 or less per ton when volume reaches 800 tons, but little economy to scale is realized thereafter. Differences among various methods of on-farm processing of feed are of less importance than the effect of volume on unit cost and the adaptability of any particular combination of facilities to the needs of an individual farm.

An economic evaluation of harvesting and handling corn on Corn Belt farms has been completed. The popularity of the self-propelled combine with corn-head attachments continued during the 1963 corn harvest, with significant increases in the use of both 2-and 4-row heads. Domestic shipments of 2-row corn heads amounted to about 12,000 in 1963 compared with 8,000 in 1962. The shipments of 4-row corn heads, marketed first in 1961, increased from about 600 in 1962 to 1,000 in 1963. Interest in narrow-corn is reflected by four major machinery companies producing equipment to harvest corn planted in 30-to 34-inch rows. The demand for drying equipment and shelled corn structures was also high in 1963, with the increase in size of structures the most noticeable change from previous years. Batch-in-bin and in storage drying units accounted for most of the increase in drying in 1963. Batch dryers are declining in relative

importance because of competition with continuous flow and batch-in-bin systems. A strong interest was indicated by farmers in the Corn Belt in 1963-64 in the economics of commercial drying and storage of corn to be marketed.

Two major farm machinery companies now have low-cost attachments, at about $150, for their combines that can be used to pick and grind ear corn in the field. The corn-and-cob mix harvested by combines generally is not cracked and broken sufficiently for good storage and feeding quality. A mounted field picker and grinder manufactured by a third machinery company and first used in 1963, shows promise in reducing the problems of scheduling the jobs in harvesting and storing high-moisture ground ear corn. Since this machine rolls the corn-and-cob mix, all kernels are cracked with a minimum amount of fines. Three manufacturers of farm structures marketed new or redesigned structures for high moisture corn in 1963.

Harvesting ear corn is still the most important method used in the Corn Belt, 74 percent of corn harvested for grain being harvested in this way in 1963. Field shelling increased at an annual rate of 2 to 3 percentage points from 1956 through 1960, with an estimated 15 percent of the corn field-shelled in 1960. During 1961 through 1963, farmers changed to this method of harvesting more rapidly, with increases of three to four percent each year.

Field shelling accounted for an estimated 26 percent in 1963. About 51 percent of the field shelled corn was dried and stored on the farm for feed or future marketing. The second most important method of handling shelled corn was harvesting and hauling direct to market, 31 percent. Other methods of handling shelled corn included (1) dried and stored off farm for future sale or feed, 8 percent; (2) stored on farm as wet corn, 6 percent; and (3) harvested and dried and marketed without farm storage, 4 percent.

A manuscript, "Harvesting and Handling Corn, Nine Major Corn Producing States, 1963," is in progress.

<u>A study of the extent and costs of using chemicals on cotton in 14 selected geographic areas, where the boll weevil causes considerable damage, was completed.</u> These areas account for about 40 percent of the U. S. cotton acreage. Primary attention was given to the use of insecticides; however, estimates also were made of the use of herbicides, defoliants, desiccants and fertilizer for 3 sizes of farms in each of the 14 areas. Estimated total costs of all specified chemicals, per planted acre of cotton in 1961, averaged about $17.75 for the materials plus about $5.30 per acre for application or a total of about $23. Estimated costs per acre of cotton treated was about $13 for insecticides, $10 for fertilizer, $3 for herbicides, and $2.50 for defoliants and desiccants. The published report contains data by areas and by size of farm.

In a study of the economics of mechanization on Mississippi cotton farms, attention has been given to the effects of harvesting conditions on cotton quality. The effect of harvesting methods on cotton quality was markedly less than farmers and ginners had previously estimated. Cotton grade was higher for handpicked than for machine picked cotton, but the difference was less than a grade. Gin turnout, contrary to popular belief, was better for machine picked cotton where 1,533 pounds of seed cotton yielded 500 pounds of lint. It took 1,583 pounds of handpicked seed cotton to yield a similar amount of lint fiber. Staple length, percentage of seed turnout, and percent ginning waste were almost identical for the two methods of harvest.

An economic analysis of skip-row planting of cotton in the Yazoo-Mississippi Delta has been completed. Results indicate that skip-row planting of cotton on better soils was considerably more profitable than the next best alternative crop. Where adapted soils were available the most profitable skip-row pattern was plant 2, skip 2. However, all skip-row patterns studied were more profitable than alternatives on sandy and loam soils. Plant 4, skip 4 was more profitable on well-drained clays, as well as on sands and loams. The analysis of linear programming results indicates that returns are increased on farms where skip-row cotton is planted so long as no solid cotton is forced onto the poorer clay soils. Thus the extent and type of skip-row planting used on an individual farm is determined to a considerable extent by the soil resources on that farm.

Optimum farm plans for the Southern Piedmont Field Station were developed. Several optimum farm plans were programmed. These included: (1) a crops-dairy (Grade B)-beef system, (2) a crops-beef system, (3) a crops-cow-calf system, (4) a beef system including grazing and feedlot operations, (5) a crops-dairy system, (6) a dairy system, and (7) a crops system. These farm organizations were programmed to use as a guide in developing a new farm plan for this particular farm unit. The information can also be useful to farmers in the area with farms having similar resource characteristics.

Some preliminary results are available from an economic appraisal of alternative systems of farming and ranching in the Great Plains Area of Oklahoma. They indicate that high income, high variability plans were those that included heavy grazed steers with unlimited nonland operating capital; low income, low variability plans were those that included cow-calf enterprises and limited nonland operating capital. Reduced variabilities were brought about by a shift in livestock produced and a change from continuous wheat to a wheat-sorghum rotation. An analysis of the implications of different tenure arrangements indicate that an owner-operator could expect higher incomes and lower relative variability than a tenant-operator. Two sequences of favorable and unfavorable years were simulated, based on historical data, representing (in effect) the most favorable and least favorable starting points for capital accumulation and financial survival. This analysis shows that operators of the larger

balanced cropland-range and primarily cropland units, regardless of tenure class, could financially survive the simulated run of unfavorable years. However, apparently only the owner-operated large scale ranch firm could survive the sequence of unfavorable years with the assumption of $3,500 for annual family living costs. These data suggest the necessity of expansion in size of present farm and ranch units, and imply that the optimum farm or ranch plan, under static assumptions, would not necessarily be appropriate when risk and uncertainty conditions are introduced.

A study of adjusting to increasing salinity on dry-farmed lands of the Rio Grande Valley was carried through its second year. Data collected on cropping practices, inputs and yields were summarized for the 2-year period and made available to local ARS and SCS personnel.

B. Economics of Conservation Practices.

An economic appraisal was made of the use of water for irrigation on Missouri farms. The data from the first year (1963) of the controlled field experiments were analyzed and reported in the Special Report Series of the Missouri Agricultural Experiment Station. The results indicated that irrigation increased the yield of corn sufficiently to cover all variable costs, but not sufficiently to cover the equipment ownership costs of irrigation. A comparison of the number of drought-day occurrences in the 1963 growing season with the probability distribution derived from past weather records reveals that a greater response to irrigation than was obtained could be expected 5 years out of 10. These results will indicate to farmers the magnitude of economic returns which can be expected from irrigation and their relative frequency of occurrence. The data from the corn date-of-planting study was prepared for analysis. A program was developed to determine the number of drought-days associated with the reported yield observations. Drought-days, average temperatures, and amounts of precipitation were tabulated by selected growth periods during the development of the corn plant. Regression analysis is to be used to determine the relationship of these selected weather variables to yield.

A study of adjusting to declining well yields in irrigated crop production on the Texas High Plains has been completed. One report has been published and another has been submitted for clearance. The first report indicates that a highly effective use is made of water pumped from low capacity wells. Special management practices (skip-row planting and alternative furrow irrigation), a rather heavy per acre investment in irrigation facilities, and a long pumping season are required to utilize the low heads of water available for irrigation. Increased fertilization did much to offset the decline in water supplies. The second report deals with costs and net labor requirements associated with sprinkler irrigation. Because of the heavy investment in power and equipment, sprinkler

irrigation costs are considerably higher than those for gravity flow irrigation. Both costs and labor requirements decline as the size of the sprinkler system increases. There is little opportunity for cost-cutting adjustments on systems delivering less than 450 gallons per minute or on farms where the labor saved cannot otherwise be employed.

<u>An economic evaluation of changes in use of farm lands within Wisconsin watershed projects was completed</u>. A survey has been made of about 150 farmers who had some land located on the flood plain land of Mill, Coon and Twin Parks creeks in western Wisconsin. Analysis of this survey data has been completed. The analysis has had the primary objectives of determining (1) changes in use (anticipated and realized) of flood plain land located in the three watersheds and (2) the effect of the realized changes on farm organizations and income. Analysis has been completed and reports of the findings are in process of publication. Preliminary results from the Mill Creek watershed have already been reported. In the Twin Parks watershed 54 out of 340 farmers had flood plain land which could be affected by the proposed flood control program. According to the watershed work plan these 54 farmers were expected to convert 437 acres (about 8 acres per farm) of flood plain land from pasture to cropland. The annual enhancement value of this conversion was estimated at $24.81 per acre; it comprised about one-fourth of the total benefits in the projects favorable benefit-cost ratio.

The study revealed that some acreage of steeper cropland might be returned to pasture use as a result of more flood plain cropland becoming available. This adjustment would be generally a favorable conservation development but one that might counterbalance the effects of flood plain land conversion since farmers are generally short of cropland. Also, the value of converting flood plain pasture to cropland depends on other aspects of farm size, and size and management of livestock enterprises. Because of the uncertainty attached to appraising the value of converting flood plain pasture to crop uses, an alternative approach is suggested which would take into consideration: (1) the need for capturing all of the benefits of the watershed project by considering the "whole farm" rather than only converted acres on the flood plain; (2) the encouragement of efficient conservation farming by computing long range conservation benefits and recognizing that the watershed project can be a vital factor in promoting conservation farming; and (3) the potential changes in farm organization (both crop and livestock) that can be triggered by a change in use of flood plain land. Since farms in the watershed are short on cropland (relative to more efficient farm units on similar soils) the potential benefits of adding only a small acreage of cropland on the flood plain may not be as significant to individual farmers as the watershed project might be to improved conservation and farm management generally.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Economics of Farm Management Practices

Davan, C. F., Jr., Anderson, R. L., and Hartman, L. M. 1963. Agricultural characteristics and fertilizer practices in the Cache La Poudre-South Platte irrigation area of northeastern Colorado. Colo. Agr. Expt. Sta. TB 78. 25 pp.

Davan, C. F., Jr. and Anderson, R. L. 1963. Economic analysis of phosphate fertilizer on irrigated alfalfa in northeastern Colorado. Colo. Agr. Expt. Sta. TB 80. 15 pp.

Davis, V. W. and Andrew, F. W. 1963. Batch-in-bin drying. Dept. of Agr. Econ., Univ. of Ill. FMFO Letter 63-13. 2 pp.

Davis, V. W. 1963. Corn: Sell at harvest or store? Dept. of Agr. Econ., Univ. of Ill. FMFO Letter 63-14. 2 pp.

Davis, V. W. 1964. Costs of storing shelled corn on farms. Proceedings of Agricultural Industries Forum, Univ. of Ill., pp. 1-10.

Davis, V. W. 1964. Sharing costs of field shelling, drying, and storing corn. Proceedings of Annual Meeting of Illinois Farm Managers and Rural Appraisers, pp. 10-11.

Davis, V. W. 1964. Wet corn--shelled or ground ear. Dept. of Agr. Econ., Univ. of Ill. AE-3997. 8 pp.

Langsford, E. L. 1964. Extent and costs of using chemicals in cotton production, selected areas. ERS-155. 15 pp.

Lindsey, M. M. 1964. The effect of harvesting conditions on cotton quality in the Yazoo-Mississippi Delta. Mississippi Farm Research 27(8), pp. 4-6.

Nodland, T. R. 1962. Annual report southeastern Minnesota farm management service. Minn. Agr. Econ. Rpt. 269. 28 pp.

Nodland, T. R. 1962. Annual report southeastern Minnesota farm management service. Minn. Agr. Econ. Rpt. 270. 28 pp.

Nodland, T. R. 1962. Annual report southeastern Minnesota farm management service. Minn. Agr. Econ. Rpt. 275. 28 pp.

Nodland, T. R. 1963. Annual report southeastern Minnesota farm management service. Minn. Agr. Econ. Rpt. 276. 28 pp.

Shaw, C. Scott, Clayton, Joe E., and Lindsey, M. M. 1964. Cotton gleaning. The Cotton Gin and Oil Mill Press 65(8), pp. 30-31, 34-35.

Sitler, Harry G. 1964. Costs of farm machinery on eastern Colorado wheat farms. Colo. Agr. Expt. Sta. Bul. 521S. 32 pp.

Thorfinnson, T. S. and Epp, A. W. 1964. Cost of operating tractors in Nebraska, 1961. Nebr. Agr. Expt. Sta. SB-480. 12 pp.

Van Arsdall, Roy N. 1964. Emerging patterns of feedlot management in the midwest. Dept. of Agr. Econ., Univ. of Ill. AE-3999. 31 pp.

Van Arsdall, Roy N. 1963. Guides for use in planning beef feeding systems. Dept. of Agr. Econ., Univ. of Ill. AE-3971. 15 pp.

Van Arsdall, Roy N. 1963. The effect of unit size on cattle feeding profits. Dept. of Agr. Econ., Univ. of Ill. AE-3903. 10 pp.

Van Arsdall, Roy N. 1963. Producing beef in a 1,000 head capacity system. Dept. of Agr. Econ., Univ. of Ill. AE-3974. 11 pp.

Van Arsdall, Roy N. and Hinton, R. A. 1964. Guides for use in planning hog production systems. Dept. of Agr. Econ., Univ. of Ill. AE-3973. 11 pp.

B. Economics of Conservation Practices

Hughes, W. F. and Magee, A. C. 1964. Economics of low capacity irrigation wells, Texas High Plains. Texas Agr. Expt. Sta. MP-710. 16 pp.

Stauber, M. S., Decker, W. L., and Miller, F. 1963. Incidence of drouth conditions in southeastern Missouri. Mo. Agr. Expt. Sta. Res. Bul. 836. 39 pp.

Stauber, M. S. and Miller, F. 1964. Corn yield response to nitrogen and irrigation in southeastern Missouri, 1963. Mo. Agr. Expt. Sta. Spec. Rpt. 39. 11 pp.

AREA NO. 3. STRUCTURE OF AGRICULTURE AND ECONOMICS OF FARM SIZE

Problem. The rapid rates of change in the nature and scope of American agriculture are generating many pressing questions. Foremost are questions on the direction and magnitude of current trends in the structure of agriculture. What changes are occurring in the numbers of the various sizes and kinds of farm? How are working relationships between farmers and non-farm businessmen changing? Equally significant are questions concerning causes and effects. What monetary incentives and other forces encourage changes in the structure of agriculture? How are farm people, rural communities, and agricultural businesses affected? These are fundamental problems on which greater depth of understanding and information are needed by policy makers, farm leaders, farm people, and the general public.

USDA AND COOPERATIVE PROGRAM

New forms of vertical coordination have influenced American agriculture in recent years and old forms have received new recognition. Basic analysis has been designed to provide a description and clearer understanding of existing kinds of vertical coordination and to suggest improvements.

Changes in the number, size, and characteristics of the farm businesses in which American agriculture is organized are continually measured and interpreted. In analyzing these changes, special attention is given to the relative position of various size groups of farms. These relative positions are being developed in terms of total farm marketings, net farm income and farm investment, use of land and hired labor, and the age and tenure of operators.

Farm size patterns are rapidly changing throughout most of American agriculture. Economic forces are an important causal agent in these changes. Some of these forces can be measured, giving policy makers and others a clearer understanding of the nature, causes, and effects of impending changes in farm size patterns. The work in economics of farm size is directed toward an analysis of some of these economic forces. The potential efficiency and profitability of different sizes of farm are being appraised for major types of farming in selected areas. Further refinement of this analysis includes an appraisal of the feasible and likely future changes in farm size patterns as farms gravitate toward more efficient or more profitable sizes. This includes a consideration of the present position of actual farms in the selected areas, and the impediments these farms will encounter as they strive for more efficient or more profitable sizes and organizations. Initially this analysis will take place at the individual farm level. The growth of the firm is

analyzed in a multiple-period context, taking into account the farm's present size and equity position, and the availability of additional resources, including labor, credit, and land. This leads to a consideration of the simultaneous development of all the farms in the selected area. Thus, the analysis is eventually conducted at the farming-area level of aggregation. Preliminary phases of the work have been completed for cotton farms in Texas and are nearing completion in California, Washington, Minnesota, Colorado, and Illinois, on six types of farm--cotton, wheat, dairy, beef feedlots, corn and hogs. Work has been initiated for tobacco farms in North Carolina. The work will be extended to additional areas and types of farming as resources become available.

A line of work is being conducted to determine the complements of resources needed to enable farm operators to have specified levels of annual earnings for their labor and management. The levels of operator earnings selected for the study are $2,500, $3,500, $4,500, and $5,500. Resource requirements for these income levels have been estimated for 14 types of farming in 29 areas widely distributed throughout the United States. These findings are presented in a forthcoming report. Future work on this subject will be conducted as part of a more inclusive study of the economics of farm size, discussed above.

Important beliefs and values underlying the economic and social developmental problems of rural America are being examined. Special attention is given to providing a deeper understanding of the nature and causes of the evolving problems, as a guide to the formulation of effective national, State, and local policies.

A total of approximately 11.9 Federal professional man-years is being devoted to this research area: Vertical coordination, 2.0 man-years; economics of farm size and numbers of farms, 8.5 man-years; and program leadership, 1.4 man-years.

PROGRAM OF STATE EXPERIMENT STATIONS

The State Experiment Station's research dealing with the structure of agriculture and economics of farm size emphasizes the cost advantages and competitive position of given agricultural industries and producers located in various areas and regions. The objectives of these studies are to determine the physical and/or cost advantages of producing pork in selected areas of the United States; to analyze the present and future comparative advantages of producers of deciduous fruits and vegetables in a given State, to evaluate alternative systems and size of egg producing units in a given area relative to other areas and to ascertain the competitive position of dairy farmers in the Northeast relative to producers in other regions. The total State effort devoted to this area of research is 1.20 professional man-years.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Vertical Coordination

A special computer open-structure simulation study of a sector of the dairy industry was conducted to develop theory and test the application of the method to conditions containing different kinds of coordination choices. The analysis was completed and a preliminary manuscript prepared for one phase, the dairy replacement problem. Steps in the application of the method are presented in 3-way parallel--in ordinary language, in flow chart form, and in Fortran, a computer language. The results are thus in terms of a flexible working model which establishes the feasibility of the method and presents the procedures in simplified translation so that others may learn how to use it.

A study of the coordinating structure of purchased inputs for farm production was initiated. First focus is on agricultural chemicals, but a broad descriptive analysis of all purchased inputs will be turned toward structural relationships.

B. Economics of Farm Size and Numbers of Farms

Analysis of aggregative data on the number and production of farms, in terms of an expanding and a contracting sector, has led to a clearer understanding of the changing nature of American agriculture. The dividing line between the expanding sector of larger farms and the contracting sector of smaller farms appeared to be about $10,000 worth of farm sales during the 1950's. This dividing line has been steadily rising in line with technological advance and higher standards of living The total number of farms declined by 2.4 million from 1939 to 1964, but 95 percent of this decline is explained by the disappearance of very small farms producing less than $2,500 worth of sales (at 1959 prices). Meanwhile, the number of farms producing over $10,000 worth of sales more than doubled. Yet the average marketings of these farms increased by only 20 percent. Research findings show that, contrary to common belief, America's farm production is not being concentrated on a few large "factory" farms, but rather on an expanding number of proficient sized farms, most of which are family farms. The total value of resources (in constant dollars) used by farms remained almost constant during the 1939 to 1964 period. But the composition of inputs changed drastically--more capital and less labor is being used. These changes in the structure of agriculture have left land tenure patterns unchanged, with about 55 percent of all farmland under owner-operatorship, 35 percent under rentership, and 10 percent under paid management. Further findings indicate that the age of farm operators is not different from that of all other self-employed occupational groups. In 1959, the average age of farm operators in the expanding sector was 46 years, compared with 52 years in the contracting sector. The higher age level in the contracting

sector is partly explained by the inclusion of 400,000 part-retirement farm operators whose average age was 71 years.

Efficiency of various sizes of farms is being determined for 8 different types of farming in 9 selected areas. This work has reached the findings stage in two studies--cotton farms in Texas and specialized beef feedlots in Colorado. The results show that in the Texas High Plains a 440-acre cotton farm operated by one man with a 64 horsepower tractor and a full complement of 6-row field equipment can be more efficient than any larger farm size presently considered feasible in that area. However, farms ranging up to 1,700 acres and employing as many as four full-time hired men, with a full set of large equipment for each man, can be almost this efficient. The high volume of these bigger farms provides an attractive total profit for farmers who can gain control of the necessary capital (over $1 million) and who can coordinate the efforts of several regular hired men. The drive toward larger farm size is motivated by possibilities of greater profit, not lower average cost. Preliminary results of the Colorado beef-feedlots study show that important economies may be exploited up to lot sizes that can handle about 3,000 head of yearlings at one time. Beyond that size the cost curve is relatively flat, as far as the analysis was able to carry it (15,000-head capacity). Five studies are now in the computing stage, and are nearing completion. These include wheat farms in Washington, dairy farms in Minnesota, cotton farms in California, and corn farms and hog farms in Illinois. Two other studies are in the preliminary steps of development--vegetable farms in California and tobacco farms in North Carolina.

The analysis of minimum resources required for specified levels of operator earnings has been completed, and a manuscript has been prepared. Major types of farm in 29 selected areas where programed for four levels of operator earnings: $2,500, $3,500, $4,500, and $5,500. The budgets used characterize the more progressive farms, rather than average or typical situations. The results showed considerable variation among areas and types of farm with regard to the amounts of yearly gross sales and investment required for the various levels of operator earnings. At the $2,500 level of earnings, the required amount of gross sales, as calculated for the 29 study areas, ranged from $6,750 to $26,450; nearly all were above $10,000. For the highest level of earnings considered, $5,500, the range in sales was from $14,990 to $62,100; most exceeded $20,000. Similar variations were found in the amount of invested capital needed. To yield annual earnings of $5,500, the required investment in land, buildings, livestock, and equipment ranged from $28,270 to $353,150; investment exceeded $100,000 on eight of the farms. At the $2,500 level of earnings, total investment ranged from $12,050 to $160,300; it exceeded $50,000 in 12 of the 29 areas. The annual investment capital cost was calculated at 5 percent. This means that families established in farming with a large equity in the farm have considerably more income for

family living than families of beginning farmers who have little or no equity and depend largely on labor and management earnings. In fact, returns to capital computed in this way were frequently greater than returns to operator labor and management.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Vertical Coordination

Davidson, Jack R. and Mighell, Ronald L. 1964. Research on coordination of farm and nonfarm stages of production -- The need is now. Jour. Farm Econ. 46(2), pp. 489-491.

Mighell, Ronald L., Jones, Lawrence A., and Gavett, Earle E. 1964. Contract production of truck crops, 12 selected areas, United States. ERS-152. 31 pp.

B. Economics of Farm Size and Numbers of Farms

Moore, C. V. 1963. A method of selecting least-cost irrigation water distribution systems. Jour. Farm Econ. 46(5), pp. 1238-1242.

Nikolitch, R. 1964. Our 100,000 biggest farms. Agr. Econ. Rpt. No. 49. 27 pp.

AREA NO. 4. FARM CAPITAL, CREDIT, AND FINANCIAL CONDITION

Problem. Farm capital and credit requirements, and the financial condition of farmers, are changing continuously. The changes result from the explosive effects of new technologies in agriculture, from the increasing integration of agriculture and other industries including contracts for production, and from changes in farm prices, income, land values, and types and sizes of farms. Continuous study is needed to keep abreast of the changing capital requirements for various tenures, types and classes of farms, and to determine how farmers accumulate the capital needed for their operations and whether credit institutions are providing adequately for farmers' changing credit needs. Better tools need to be developed for measuring the effects of the changes in agriculture and in farm capital and credit requirements on farmers' assets, debts, and equities. Studies are needed for the guidance of farmers and credit institutions and to aid policymakers and program administrators in appraising the effects of farm programs.

USDA AND COOPERATIVE PROGRAMS

The work in this area comprises a long term program of statistical and economic research in three principal areas: The balance sheet of agriculture and financial outlook; improvement of farm mortgage credit facilities; and short term credit and financial management.

In Washington, D. C., the work on the balance sheet of agriculture and financial outlook involves chiefly the assembly and analysis of data on farm assets, debts, and incomes and on factors affecting the financial situation of farmers. The Division has become a clearing house for data on farm debts, to which the major lenders (or their supervisory authorities) report on their own loans to farmers and look for comprehensive information on the entire farm debt situation. In addition the Division assembles data collected elsewhere in the Department and by some other agencies on farm assets and incomes and issues each year two analytical reports: (1) "The Balance Sheet of Agriculture," which measures and explains changes during the last year in the financial situation of agriculture; and (2) the "Agricultural Finance Outlook," which projects current trends and estimates what the farm financial situation will be during the next year. These publications contain the only available comprehensive analyses of the farm financial situation.

As an aid in preparing the Agricultural Finance Outlook, surveys usually are made in the fall to determine the views of farmers, credit institutions, merchants, and dealers concerning the current farm financial situation and prospects for the coming year.

In the work on improvement of farm-mortgage credit facilities in Washington, D. C., data from all available sources are assembled and consolidated

to determine the amount and distribution of the farm-mortgage debt, the terms on which farm-mortgage credit is available from the principal lenders, the current volume of loans and repayments, and the extent of farm-mortgage debt delinquencies and foreclosures. Quarterly reports on the mortgage lending activities of the major life insurance and Federally-sponsored agencies are obtained and analyzed. At 5-year intervals, immediately following the Census of Agriculture, cooperative surveys with the Census are made to determine the amount of farm mortgage debt held by nonreporting lenders, and the distribution of all mortgage debt among the various types, sizes, and economic classes of farms. The data from this activity are used in computing parity prices for agricultural products and in preparing the Balance Sheet of Agriculture, the Farm Cost Situation, and the Farm Income Situation; they also are used regularly by the National Agricultural Credit Committee, which meets three times each year to appraise the farm-mortgage situation. Numerous requests for data on the farm-mortgage situation are received each year from legislators, farm organizations, farm journals, the State agricultural experiment stations, and others.

In Columbia, Missouri, cooperative studies with the Missouri Agricultural Experiment Station are being made to determine how rural housing is financed and the role of the housing loan program of the Farmers Home Administration in promoting better housing for rural people.

In the research on short-term credit and financial management, statistical work in Washington, D. C. is similar to that done on farm-mortgage credit, that is, serving as an assembly point and clearing house for information on the non-real-estate credit used in agriculture, and analyzing and interpreting the data. The data from this part of the work have uses similar to those for the data on mortgage credit, except that they are not used in computing parity prices of agricultural products. These data are in wide demand. A major project currently underway is the analysis of data from a survey, cooperative with the Census Bureau, of the way in which farm debt is distributed among various classes of farmers and of the financial situations of farmers who are most heavily indebted in relation to their assets and incomes. From data obtained from the survey it has been possible to prepare a major revision of non-real-estate debt owed to merchants, dealers, and other nonreporting creditors.

Cooperative work with the agricultural experiment stations of the respective States includes the following: At Madison, Wisconsin, a study of financial management on commercial farms; at East Lansing, Michigan, studies of capital accumulation on farms, financing problems of large-scale farming operations, and studies of farm managerial processes and performance; and at Urbana, Illinois, a study of the financing of mechanized cattle feeding operations.

Federal professional man-years devoted to this work total 8.7 divided as follows: Balance sheet of agriculture and financial outlook, 1.2 man-years; improvement of farm mortgage credit facilities, 3.4 man-years;

short-term credit and financial management, 3.7 man-years, program leadership, 0.4 man-years.

These cooperative studies were terminated during the period: (1) A cooperative study at Madison, Wisconsin of management services rendered by lending institutions in extending credit to farmers and (2) a cooperative study with Montana of the factors affecting the cost and availability of rural housing credit in that State.

PROGRAM OF STATE EXPERIMENT STATIONS

The larger size farm units involving heavy cash outlays for operating expenses, necessitate capital accumulation and the use of credit. Adjustments in farm organization and operations have been proceeding at a rapid rate. Fourteen studies dealing with financial management problems are being made. These studies represent an attempt to identify and appraise the many facets involved. Studies conducted have been concerned with farmers' use and knowledge of credit, amount and types of loans needed, extent to which lending agencies are adjusting their operations to meet farmer-borrower requirements, and factors affecting costs to both the borrower and lender. Security requirements, terms of repayment, and availability of funds when needed are being investigated. The structure of the capital market and the flow of long-term credit between agriculture and the rest of the economy is an area of inquiry. The matter of risk is always present and is not being ignored in studies being conducted. Estimates are being made of returns to inputs of capital and labor and the productivity of capital in alternative uses for different sizes and types of farms. A total of 6.9 professional man-years are devoted to this area of work.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. The Balance Sheet of Agriculture and Financial Outlook

Farm assets and equities and cash receipts from farm marketings reached new highs in 1963. The value of farm assets on January 1, 1964 was $223.3 billion, up $7.5 billion from a year earlier. Owners' equities in these assets totalled $188.4 billion, $4.4 billion more than a year earlier. Cash receipts from farm marketings reached $36.9 billion in 1963, up $800 million from 1962.

The Nation's farmers realized a record gross farm income of $41.7 billion in 1963 compared with $40.9 billion in 1962. But with a somewhat larger increase in production expenses than gross income, realized net farm income declined slightly from $12.6 billion in 1962 to a level of $12.5 billion in 1963. On a per farm basis, realized net farm income was a record high of $3,504 compared with $3,420 in 1962. Personal income per capita of the farm population from farm and nonfarm sources rose in 1963 to an estimated $1,488, up from $1,426 in 1962.

Further increases occurred during 1963 in the values of farm real estate, machinery and motor vehicles, and farmer-owned crop inventories. Increases in these farm assets, totalling $9.2 billion, far more than offset declines of $1.5 billion in the value of the livestock inventory and $0.3 billion in the value of household furnishings and equipment.

Farm debts also continued to rise in 1963. On January 1, 1964 they totalled nearly $35 billion, up $3.1 billion from a year earlier. However, the increase in farm debt was much smaller than the increase in farm asset values.

Farm real estate rose in value by about $8 billion in 1963 and was chiefly responsible for the rise in farm asset values. Thus 1963 was another in a long succession of years in which rising real estate values drove up the value of farm assets and, in most years, farm equities.

Farm consolidations, rising land values, and increased use of credit are elements of a fundamental reorganization taking place in agriculture. Sizable operating units are required for effective use of the larger and more efficient machines and the advanced technologies now available, and for provision of adequate incomes to farm families. The creation of such units undoubtedly contributed to the increase in land values, since a growing proportion of all purchases of farm tracts--nearly half at present--are made for farm enlargement. Although the number of farmers is declining rapidly, the credit needs of the remaining farmers are increasing. Not only must many of these farmers buy more land, but most farmers who enlarge their units by buying or leasing land also require more livestock and machinery, and all farmers must use more purchased supply items in applying the new technologies. Because farmers cannot meet these needs for capital from current income, they are becoming increasingly dependent on credit.

B. Improvement of Farm-Mortgage Credit Facilities

Farm-mortgage (real estate) debt increased $1.6 billion or 11 percent during 1963. In 1962 this debt rose $1.3 billion, and in 1961 $1.1 billion. The average annual increase over the past three years was about $1.3 billion or 9 percent, while in the three preceding years--1958-1960--it averaged $800 million or 7 percent. The dollar amount of the increase in 1963 was the second largest of record. During 1920, following World War I, farm-mortgage debt rose by $1.8 billion or 17 percent. Mortgage lending continued to advance in the first quarter of 1964.

The amount of farm-mortgage loans made (or recorded) in 1963, including new and refinancing loans, was 17 percent above the 1962 volume. 1963 was the third consecutive year in which recordings were substantially higher than in the preceding year. The volume of mortgages recorded in 1963 was 44 percent higher than it had been 5 years earlier, in 1959.

All of the increase in farm-mortgage recordings since 1959 has been due to an increase in the average size of loan. The number of new or refinancing loans made has remained virtually constant. Because of the continuing decline in the total number of farms, the proportion of farmers and landlords incurring new or additional farm-mortgage debt each year has increased a little.

Interest rates on farm-mortgage loans continued generally stable during 1963. Repayments of existing mortgage debt continued relatively high in 1963. Very few borrowers were behind schedule in their payments, even in areas where farm incomes were unfavorable in 1963, such as in the cattle feeding or dairy areas.

Foreclosures continued to be extremely rare, and even in foreclosure cases, lenders seldom lost any of the funds they had loaned. Although farmland prices have risen markedly in relation to farm income, and mortgage debt has increased even more than land prices, there was still no appreciable evidence that debt has become excessive in relation to incomes of the borrowers.

Results of the studies in Missouri and Montana (cooperative with the agricultural experiment stations of these States) to determine factors affecting the cost, terms and availability of credit for rural housing were published during the year. Findings of these studies were given in last year's Progress Report.

In Missouri, two additional cooperative studies of rural housing have been started and the fieldwork on them is nearing completion. One of these studies, conducted in several rural counties of northern Missouri, covers about 100 persons who bought homes and about 75 who built new homes in 1963. Data are being obtained on the value and kind of homes bought or constructed, the income levels of the owners, the sources of funds (both owned and borrowed) that they used in acquiring homes, and the alternative credit terms available to them from various sources of credit. The other study covers rural housing loans made in 1963 by the Farmers Home Administration in selected areas of northern and central Missouri. It is designed to determine the part of the rural housing credit market served by that agency.

Cooperative work with Michigan resulted in the publication "Participants in the Land Market--a Profile of Renters, Buyers, and Sellers in Lower Michigan." This study showed the rapid increase in acreage that is occurring on many farms, and indicated the characteristics of the farm operators who are expanding their acreages most rapidly. Much of the increase in acreage, particularly among younger farmers, was by rental rather than purchase.

A study of the quality of farm-mortgage loans was made and published during the year. It shows that, despite the rapid increase in farm-mortgage debt during recent years, there is little if any evidence that borrowers

are becoming overburdened with debt or are having difficulty in meeting their mortgage-debt obligations.

Further work was done during the year on data from the 1960 Sample Survey of Agriculture. Part of this work resulted in publication of an article "Our Younger Farmers--Their Status in Agriculture." This article showed that, despite their small personal resources and the high and rising capital requirements at the time they started farming, the postwar generation of young farmers had been able by 1960, through borrowing capital and leasing land, to get established on farms as large as those operated by middle-aged farmers and larger than those operated by older farmers.

Two other studies are still incomplete. One will show that, in general, farm debt is distributed among farmers in accordance with the size and profitability of their operations and that relatively few farmers appeared to be very heavily indebted at the end of 1960. The other will show the significant characteristics of the farmer-borrowers obtaining mortgage credit from each of the several major institutional and noninstitutional credit sources, and the important characteristics of the kinds of credit borrowers were able to obtain from each source. Individual sellers of farms and the Farmers Home Administration were sharply distinguished from other lenders in having as clients a preponderance of young, newly-established farmers. As farm operators became older and more firmly established, and their equities improved, they tended to rely chiefly on such cooperative or private institutional sources as Federal land banks and life insurance companies. Mortgage credit facilities appeared less adequate in the South than in the North or the West.

C. Short-Term Credit and Financial Management

Total non-real-estate farm debt, including debt owed to merchants and dealers and other nonreporting creditors and CCC loans, reached $18.1 billion on January 1, 1964, an increase of $1.7 billion from a year earlier. Debts to reporting institutions and to the nonreporting creditors groups increased sharply during 1963 while CCC loans declined a little.

This was the second consecutive year of exceptionally large expansion in non-real-estate farm debt. During 1961, this debt rose by about $1 billion, and in 1960 it rose by 1/2 billion dollars.

Increases in non-real-estate debt in 1963 were largest in parts of the South and in many Mountain and Pacific States. In the Northeast, the Lake States, the Southeast, and the Corn Belt increases were less than average. The less favorable price and income situation for dairy farming, an important enterprise in many Eastern and Northern States, and the unfavorable income of cattle feeders particularly in the Midwest, probably were factors in the smaller increase of debt in these areas.

During 1963 in the Corn Belt there were reports of an increased volume of loan renewals at banks, apparently reflecting some delayed marketings of

cattle and feeding to heavier weights. Renewals of loans among PCA's were slightly higher in 1963 than in the previous year. However, there were no indications, on the one hand, of serious repayment difficulties by borrowers, or, on the other hand, that credit was being unduly curtailed so that significant number of farmers were unable to obtain loans from their usual credit sources.

During the year a report, "Technical Appraisal of the 1960 Sample Survey Estimates of Farm Debt," was prepared and published. This publication indicated how completely the Census survey had accounted for the amount of farm debt and how accurately it had distributed the debt among the various credit sources. On the basis of this appraisal a new estimate of the short-term farm debt held by nonreporting creditors on January 1, 1961 was made, and this new estimate was used as a benchmark for revising the estimates of this series that had been made before the new benchmark was established. The effect of the revisions was to substantially raise the earlier estimates. For January 1, 1963 the earlier estimate ($4,200 million) was raised to $6,020 million. The revision covered the period 1949 to 1964.

Cooperative work with the Michigan Agricultural Experiment Station included a report "The Michigan Farm Credit Panel--Cash Flows and Use of Credit--1961." This is the first study in which farmers' receipts and disbursements arising from household and family needs, nonfarm investments, and credit transactions were considered as well as the receipts and disbursements for strictly farm purposes. An interesting revelation of the study is that a fourth of the cash inflows of the average panel member during the year came from loans, and that the loans were used in the proportion of 1/3 for operating expenses and 2/3 to build up the farm capital used by the panel members.

The cooperative work at Michigan included a statistical study of factors associated with the management ability of farmers. It is well known that wide variations in management ability of farm operators exist but very little is known of the components of effective managerial ability, and no objective techniques for measuring these abilities exist. This continuing research is designed to provide further insight into each of these areas.

Cooperative work with the Wisconsin Agricultural Experiment Station produced three publications during the year. One was "The Role of Farm and Financial Management in Production Credit Associations in Wisconsin," the major findings of which were included in last year's Progress Report. The other two publications dealt with the various phases of the progress of Farmers Home Administration borrowers in Wisconsin as revealed by FHA records. The more important findings were reported in "Farm Adjustments Made by Wisconsin Farmers Home Administration Borrowers." The progress made by FHA borrowers who were in need of intensive supervision was analized, particularly the ability of these borrowers to improve their farms and "graduate" to private credit sources. It was found that this group as a whole had made moderate and consistent economic gains but that further

progress was needed to enable them to attain an adequate level of income and to compete successfully with other commercial farmers. Significantly, farm ownership borrowers who had entered the program after 1957 were in the most favorable position as they had larger farms than the borrowers who entered before 1957. Among these earlier borrowers, more than half reported increases in off-farm earnings in the period 1957-1961. About one-third of the borrowers, however, reduced their off-farm work as they moved closer to full time commercial farm operations. Significantly, all categories indicated economic progress but they utilized farm and nonfarm resources in different amounts and degrees. Other credit agencies as well as the FHA have shown interest in the results of these studies. This was particularly true of many Wisconsin rural banks who are becoming increasingly aware of the importance of credit tied to farm management. In addition to the publications, administrative reports were made to FHA for internal use.

In the coming year cooperative work in Wisconsin will include survey work and analysis of financial management problems on Wisconsin farms. Some farmers who apparently have solved their livestock and crop production problems are experiencing acute financial problems. This study is for the purpose of detecting the reasons for the financial problems even on high producing farms; it is expected the study will provide needed guides and procedures for more successful operations.

At Urbana, Illinois a study is underway to determine whether or not farmers should invest in mechanized cattle feeding systems. Linear programming techniques are being used to show the contribution to total farm income of a mechanized feeding system in comparison with the contributions of the other farm enterprises. Amounts of capital and credit required to finance these investments, and feasible credit programs, are included in the study.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Balance Sheet of Agriculture and Financial Outlook

Farm Production Economics Division. 1963. 1964 agricultural finance outlook. ERS-AFO-3. 38 pp.

Garlock, F. L., Allen, P. T., Jones, L. A., Scofield, W. H., and Shapiro, H. 1963. The balance sheet of agriculture, 1963. ERS-AIB-281. 25 pp.

B. Improvement of Farm-Mortgage Credit Facilities

Allen, P. T. and Eitel, V. E. 1964. The quality of farm-mortgage loans. Agricultural Finance Review, Vol. 25, pp. 23-36.

Eitel, V. E. 1963. Characteristics of farm mortgages recorded January 1 through March 31, 1961. ERS-136. 4 pp.

Farm Production Economics Division. 1963. Farm mortgage debt. FMD-2. 7 pp.

Farm Production Economics Division. Farm-mortgage lending experience of life insurance companies, the Federal land banks, and the Farmers Home Administration.

November 1963	FML-9, 7 pp.
February 1964	FML-10, 7 pp.
April 1964	FML-11, 12 pp.
July 1964	FML-12, 8 pp.

Garlock, F. L. 1964. Our younger farmers--their status in agriculture. Agricultural Finance Review, Vol. 25, pp. 45-51.

Cotner, M. L., Wirth, M. E., and Irvin, G. D. 1964. Participants in the land market--a profile of renters, buyers, and sellers in Lower Michigan. Michigan Agr. Expt. Sta. Res. Rpt. 12. 6 pp.

Hesser, L. F. 1963. The market for farm mortgage credit. Purdue Agr. Expt. Sta. Res. Bul. 770. 21 pp.

Sargent, R. L., Davidson, J. R., and Jones, L. A. 1964. Availability of rural housing credit in Montana. Montana Agr. Expt. Sta. Bul. 43 pp.

Williams, D., Jones, L. A., and Miller, F. 1964. Financing rural homes in Missouri. Missouri Agr. Expt. Sta. Res. Bul. 857. 47 pp.

C. Short-Term Credit and Financial Management

Christiansen, R. A., and Wolter, R. 1964. Statistical summary with comparisons--Wisconsin Farmers Home Administration borrowers. Wisconsin Agr. Expt. Sta. Mimeo Rpt. 27 pp.

Garlock, F. L. and Allen, P. T. 1964. Technical appraisal of the 1960 sample survey estimates of farm debt. ERS 167. 28 pp.

Hepp, R. E., Staniforth, S. D., Peterson, G. A., and Christiansen, R. A. 1963. The role of farm and financial management in production credit associations in Wisconsin. Wisconsin Agr. Expt. Sta. Bul. 565. 12 pp.

Wirth, M. E. and Brake, J. R. 1964. The Michigan farm credit panel--cash flows and use of credit--1961. Michigan Agr. Expt. Sta. Res. Rpt. 8. 10 pp.

Wolter, R., Christiansen, R. A., and Staniforth, S. D. 1964. Farm adjustments made by Wisconsin Farmers Home Administration borrowers. Wisconsin Agr. Expt. Sta. Mimeo Rpt. 39 pp.

AREA NO. 5. AGRICULTURAL RISKS AND INSURANCE

Problem. Risk bearing is a necessary and costly function of ownership and management in farming because of production hazards and price uncertainties. Expanded research in reducing agricultural risks should prove valuable to farmers in making management decisions, and to Government agencies and private insurance and financial institutions in adjusting their policies to meet farmers' needs.

Research in this field includes possible modifications of existing insurance, credit and taxation policies, which impose excessive burdens when farm incomes are low. It also includes study of alternative means by which farmers can (1) reduce risks by the adoption of new financial and production practices, (2) shift part of the risk to insurance, financial, and Government institutions, or (3) most effectively combine these two approaches.

With rising farm-property valuations, more use of credit, inflation, and greater chance of personal injury, fatalities, and lawsuits (due to accidents arising from increased mechanization and more highway travel), more kinds and larger amounts of property, health and sickness, life, and liability insurance are required by today's farmers. There is considerable variation in premium costs among companies for identical coverages. The increased insurance coverages carried by farm operators require high premium outlays. Figures of from $1,000 to $1,500 are not uncommon. Priorities need to be established to aid farmers in allocating a given premium outlay according to need.

USDA AND COOPERATIVE PROGRAMS

A continuing program of applied economic and statistical research is carried on that involves the compilation of operating data for the farmers' mutual fire, windstorm and crop-hail insurance companies, and the analysis of problems and trends in such insurance (loss rates, expenses, proper safety-fund levels, reinsurance needs, etc.); evaluation of effects of OASDI on insurance programming and the retirement plans of farm operators, and on the tenure, number, size, organization, and management of farms; the development of farm-income distributions from OASDI data; and measurement of the causes and incidence of farm fire losses and farm accidents.

The work includes study of (1) the incidence of production risks, as reflected by yield variability and other factors, on the structure and functioning of farm units, and (2) various methods of risk bearing and financial measures that might provide guides for management decisions on feed and cash reserves, geographical dispersion of farming operations, flexibility of organization, depreciation and tax management, better planning, and insurance, from the standpoint of helping farmers improve the stability of their farm income and their prospects of survival during

periods of drought, as well as their long-run capital accumulation, and also provide guides for the action programs of government, private insurance agencies, and financial institutions.

The work is done in Washington, D. C., with the informal cooperation of the Federal Crop Insurance Corporation, the Bureau of Old Age, Survivors, and Disability Insurance, insurance trade associations, farmers' mutual companies, State insurance commissioners, State fire marshals, and in Montana, with the formal cooperation of the Montana Agricultural Experiment Station. A study of the impact of Federal crop insurance is being made in cooperation with FCIC in Montana and Virginia.

The program involves a total of 4 Federal professional man-years distributed as follows: Program leadership, 0.2 man-years; improvement of farmers' mutual fire, windstorm, and crop-hail insurance company operation, 0.3 man-years; organized farm fire protection and estimation of annual farm fire losses, 0.3 man-years; casualty and life insurance (including social security) and accident prevention for farmers, 1.7 man-years; and analysis of risks and risk-bearing in agricultural production, 1.5 man-years.

PROGRAM OF STATE EXPERIMENT STATIONS

Research concerned with agricultural risk and uncertainty conducted by the State experiment stations is designed to improve the predictability of variations in yields, incomes and prices of major crops and to compare these variations between production areas; to determine the income stability of cropping systems and to compare alternative methods of estimating yield, income and price variations. Studies are also attempting to determine the reasons for and causes of failure of farm loans and develop procedures whereby farmers and lenders might more accurately predict risks in prospective credit use.

Research on insurance is concerned mostly with insurance strategy to meet the risk and uncertainty associated with agricultural production. The objectives of these studies are to investigate farmers' attitudes regarding the use of crop insurance and other strategies to reduce farm income variability due to weather hazards, to compare the characteristics of farms and farmers who are participating in the FCIC with those who are not participating, and to evaluate the effect of alternative crop insurance programs and select organizational strategies with respect to financial survival and capital accumulation.

The total State effort devoted to this area of research is 0.70 professional man-years of which 0.55 is for agricultural risks and 0.15 for insurance.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Improvement of Farmers' Mutual Fire, Windstorm, and Crop-Hail Insurance Company Operations

A study of the operating experience of 216 sample companies showed that farmers mutual fire insurance companies were in strong financial condition at the beginning of 1964. Their surplus and reserves of $255 million were at a record level. Operating expenses, a problem of concern to many companies, declined slightly from 9.0 cents to 8.3 cents per $100 of insurance between 1962 and 1963. Losses paid on fires, however, rose from 18.3 cents to 19.2 cents per $100 of insurance. Windstorm loss payments, which normally vary from year to year, were 5.6 cents in 1963 compared to 7.7 cents in 1962. The total cost to farm mutuals for carrying insurance in 1963 was 27.5 cents per $100 of insurance, about 1 percent more than in 1962.

B. Organized Farm Fire Protection and Estimation of Annual Farm Fire Losses

Farm fire losses were estimated at an all-time high of $191 million for 1963. About seven-eighths of the damage was to buildings and the remainder to personal property. A survey of key farm mutual insurance companies indicates that the trend in farm consolidations may be a factor in the higher losses. Obsolete buildings or those no longer used are greater fire risks.

A study made for the Rural Fire Protection Committee of the National Fire Protection Associations showed that practically all States have legislation authorizing rural fire protection. Thirty-three States permit special taxing districts to provide rural fire protection. The laws of many States authorize county or township fire departments to serve unprotected areas.

C. Casualty and Life Insurance (Including Social Security) and Accident Prevention for Farmers

Work in progress on workmen's compensation insurance shows that 30 States have laws or court decisions that make workmen's compensation applicable to farm labor. Data collected from selected States indicate that about 40 percent of the payroll of farmers for hired labor is insured and that premiums for those insured amount to about 3 percent of their payrolls.

An analysis of statistics of farm accidents shows that those causing loss of time from work happen to about 20 percent of the farm people annually. Fatal accidents to farmers are at the rate of 50-70 per 100,000 persons in the farm working force--much higher than the average for all other working groups. Farm accidents continue to be most frequently associated with tractors and other farm machinery.

A study of Social Security records shows that about 3.8 million individuals reported taxable farm income for social security coverage in the 1955-61 period. Analysis of a one-percent sample reveals that nonfarm self-employment income was also reported by about 10 percent of them. One-fourth of the individuals in the sample filed returns for all 7 years and one-ninth for one year only. Many farmers, chiefly because of fluctuating incomes, filed intermittently. By the end of 1962 one-third of those filing since 1955 were entitled to Social Security benefits. Many farmers continue to report farm incomes after they become entitled to retirement benefit payments.

Data available from the one-percent sample on the level and variability of incomes of each individual give more meaning to National and State estimates of farm income. The year-to-year variation in incomes of individuals is much greater than the variation for all combined. Individual incomes are most stable from year-to-year in the Northeast and Lake States and most variable in the Great Plains, Mountain, and Pacific regions.

D. Analysis of Risks and Risk-Bearing in Agricultural Production

Federal crop insurance indemnities during drought years have an important impact on farmers and on rural lenders, businesses, and communities. Surveys made at the request of the Federal Crop Insurance Corporation in Montana and Virginia showed that FCI payments prevented serious credit and financial difficulties and averted drastic curtailment of expenditures for basic living and farming purposes. Most farm suppliers, except those selling farm equipment or other goods that farmers could postpone buying, reported sales and collection benefits from FCI indemnities. Lenders also indicated that the credit situation was helped substantially by crop loss payments. The study showed further that if more farmers had carried crop insurance the need for emergency loans from the Farmers Home Administration would probably have been less great but not entirely eliminated.

Despite the benefits of crop insurance after severe crop losses, very few lenders or creditors require customers to take it. Substantial numbers of farmers are uninsured. They usually feel the cost is too high relative to the protection or have other means of spreading production risks.

Collection and analysis of yield histories for individual State-leased tracts in Montana have been directed toward improving crop insurance premium rates. This work in cooperation with Montana State College has involved an electronic computer program for calculating pure premium rates and correlation coefficients. The basic objective is to show the relationship between yields on these individual tracts and average yields by counties, the data for which are more readily available for long periods. Computations completed for Wibaux County show more variability for tract yields than for county yields. The coefficients of negative deviation when worked out in more detail will be useful in developing formulas for premium rates and coverages. The analysis shows that another factor in making rates is the degree of discontinuity in average yields over time.

The problem here is one of choosing a representative period and establishing bushel guarantees that will be actuarially sound and meet the protection needs of farmers.

A related study involves collecting annual precipitation data for 10 weather stations in Montana and 18 in other Great Plains States. Preliminary findings indicate a lack of geographic randomness throughout the region. These findings suggest that FCIC in making rates may need to extend its planning period and accumulate larger reserves.

Another study is bringing up-to-date an earlier study of yield variability for 9 Great Plains States. This will contribute further to crop insurance work. Other States participating in the cooperative regional project have assisted in the collection of these data.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Improvement of Farmers' Mutual Fire, Windstorm, and Crop-Hail Insurance Company Operations

None

B. Organized Farm Fire Protection and Estimates of Annual Farm Fire Losses

Rush, J. D. 1964. Farm fire losses - 1963. Mimeographed. 1 p.

Rush, J. D. 1963. Rural fire protection legislation in the United States. Mimeographed. 20 pp.

C. Casualty and Life Insurance (Including Social Security) and Accident Prevention for Farmers

Rush, J. D. 1964. Farm accident statistics. Dittoed. 16 pp.

D. Analysis of Risks and Risk-Bearing in Agricultural Production

None

E. Miscellaneous

Botts, R. R. Revised 1964. Farmers' handbook of financial calculations and physical measurements. Agr. Handb. No. 230. 55 pp.

AREA NO. 6. FARM TAXATION AND RURAL GOVERNMENT

Problem. Steadily growing requirements for schools, roads, and other governmental services are placing a severe strain on existing sources of State and local tax revenue. One result has been a more than doubling in farm real estate taxes since the close of World War II, with no evidence that the steep rise will slow in the foreseeable future. Research is needed on problems of financing governmental services in rural areas and in suburban fringe areas, including consideration of the effects of taxation on agriculture, the role of the property tax in local finance, and possible alternative sources of revenue. The purpose of this research is to find ways to ease financial problems of rural governments and the tax burden on agriculture.

Problems of local finance stem partly from inappropriate forms of local governmental organization. In most States, the structure of local government in rural areas was established generations ago and has not been adapted to today's needs. Considerable experimentation is going on with new forms of governmental organization and new financial arrangements. Research is needed to analyze and evaluate this experience and make the findings available to other communities facing similar problems.

USDA AND COOPERATIVE PROGRAMS

This work includes maintenance and improvement of statistical series on the major taxes paid by farmers, and analysis of the effects of various taxes on agriculture. Attention is given to tax proposals, Federal, State or local, that appear to have important consequences for farmers or agriculture. Studies cover problems in assessment and taxation of farmland, especially in rural-urban fringe areas; the sources of revenue for rural governments; and local government structure and organization in sparsely settled areas and in rural areas around growing cities. This work involves the disciplines of economics, public finance, political science and public administration.

Cooperative work was carried on in Washington, D. C. and in New York, Minnesota, Iowa, and Illinois. Research was also carried on by non-Federal personnel under cooperative agreements in Michigan, Texas, California, Louisiana, and Missouri. Work continued on a research contract with the Bureau of Government Research of Indiana University for a study of arrangements in selected States for cooperation between units of rural local governments.

This program involved a total of approximately 6.6 man-years of Federal professional personnel in fiscal year 1964, distributed as follows: Program leadership, 0.2 man-years; estimates of the amount and incidence of farm taxes, 2.0 man-years; assessment and methods of assessing farm property, 1.9 man-years; organization and finances of local government, 2.5 man-years.

Research on the assessment and taxation of farm property in the North Central States, headquartered at the University of Illinois, was terminated during the year. Also terminated was a study of fiscal problems of declining rural counties, located in Iowa.

PROGRAM OF STATE EXPERIMENT STATIONS

Six States are conducting studies in the general area of taxation. Among the problems being investigated are equitableness of assessments among similar farms and farm property relative to nonfarm property, how to assess forest lands, impact of taxes on rural land values and on land use in selected rural and rural-urban fringe areas, and quality of services received. Problems of inequality in assessments, values, and tax rates on rural and personal property in rural areas, and basis on which property is assessed, i.e., farm values or market values, are being attacked. A total of 2.7 professional man-years are devoted to this area of work.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Estimates of the Amount and Incidence of Farm Taxes

Taxes levied on farm real estate in 1963 increased to $1,468.3 million, or 5 percent over the amount levied in 1962. These levies, imposed mostly by local units of government to support such public services as schools, roads, and welfare programs, have increased for 21 consecutive years and are now more than 3 times their level at the close of World War II. In 1963, the average tax per acre was $1.43 compared to $1.36 in 1962 and $0.44 in 1945.

Taxes per $100 of full value increased to $1.03 in 1963. This ratio, a measure of the effective tax rate on farm real estate, was the highest since 1941.

The continued uptrend in farm taxes reflects steadily growing demands on State and local governments for more and better public services. Many rural areas are attempting to upgrade such services, especially schools. The added costs fall largely on the property tax. Research in the past year has examined alternative methods of financing public services, especially in semi-rural areas around rapidly growing cities, and in areas of sparse and declining population.

An effort was made during the year to analyze the factors associated with the uptrend in the farm real estate component of the property tax base and to project these values and the taxes that would be levied on them, under the assumption of no change in the effective tax rate, to the year 1970, by States. This study was undertaken as part of a larger study sponsored by the Advisory Commission on Intergovernmental Relations, to project all State and local revenues and expenditures, by States, to 1970.

The analysis showed that in nearly every State, year-to-year changes in market value of farm real estate, as estimated by the Farm Production Economics Division, were most closely associated with corresponding changes in personal incomes. Projecting on the basis of estimates of personal income in 1970 resulted in a 1970 estimate of farm real estate values (and of taxes) 35 percent higher than in 1962 at the national level. For individual States the increases ranged from practically none (North and South Dakota) to almost 100 percent (Florida). A 35 percent rise in the U. S. total farm real estate tax levy, over an 8-year period, would represent some slow-down from the rates of increase in recent years. It would produce a ratio of tax to farm income, however, unprecedented except perhaps in the early 1930's.

<u>Taxes levied on farm personal property in 1963 are estimated at $295 million</u>. Continued mechanization of agriculture and increasing numbers and assessed values of livestock are the chief factors in the rising level of farm personal property taxes.

An effort of several years' duration to provide improved estimates of the taxes levied on each type of farm personalty, by States, was completed during the year, with publication of a report containing detailed statistics for the years 1957-62.

<u>A report analyzing the economic significance of farm personal property taxes</u> is scheduled for publication. Differences in the amounts levied on farm personalty can generally be attributed to three factors: The variation in the amount and value of the farm personal property situated in each State; the State-local revenue structure; and the specific property tax laws in each State. The primary problem in assessing and taxing farm personal property appears to be one of taxpayer equity. The property tax statutes in many States discriminate between different types of farm enterprises and between farm and nonfarm taxpayers, as well as between real and personal property. Other revenue sources would have to be developed if property taxes are to be reduced. In general, most farmers would probably have their taxes reduced if revenues from sales taxes or income taxes were used in place of property taxes.

<u>Work on the effects of the property tax on the allocation of resources on the farm was continued</u> during the year, with major emphasis being given to the development of a theoretical framework. While it appears that the effect of increased property taxes would normally be to promote more intensive land use, it seems likely that there may be important instances in which they have the reverse effect--they promote less intensive use. This is particularly likely if part of the tax is capitalized. In addition, some preliminary work was done on a study of the effects of alternative tax systems in the Northeast.

The major tax development during the past year has been <u>the Revenue Act of 1964</u>, which reduced rates significantly and made various structural changes in the Federal income tax. An analysis of the major provisions of

the Act as they affect farmers was prepared and was published within a few days after its enactment, and has since received wide distribution. The overall effect of reduced rates was estimated to be a tax reduction of $250-$300 million from the $1.3 billion paid by farmers under the old rates.

B. Assessment and Methods of Assessing Farm Property

Research on farm real estate assessment has continued to concentrate on the problem of assessing farmland located in the rural-urban fringe. More and more States are becoming concerned with this problem and with making attempts to solve it by legislation. Requests for information and invitations to address various State groups on the topic exceed our ability to comply.

Two research projects on rural-urban fringe assessment problems have been underway. One in St. Louis, Missouri, now completed, found the taxes on land, exclusive of improvements, to absorb an average of 74 percent of estimated gross farm income. Analysis of alternative methods of taxation led to the recommendation that a system of tax deferral be adopted, in conjunction with more effective planning and zoning. A parallel study in the Rochester, New York area, has found evidence of de facto preferential assessment of land remaining in agricultural use in urbanizing parts of the area.

An analysis and summarization of the results of recent research on assessment in rural-urban fringe areas was completed and two articles were published during the year.

C. Organization and Finance of Local Government

Research continued on the effects of urbanization upon local government finance and organization in cooperation with Michigan State University. A report published during the year concluded that nonfarm rural residents on the urban fringe strongly support governmental measures, such as preferential agricultural assessment, designed to help farmers. However, this support can easily be dissipated when farmers oppose additional expenditures for school purposes, which are strongly supported by nonfarm rural residents.

A study was begun, designed to identify the local governmental problems arising in three Michigan townships ranging outward from the central city to determine how urbanization affects local governments at different time periods and at different distances from the city. Preliminary findings for township government are that as urbanization increases, the formality of local government decision-making processes also increases, and this may work to the disadvantage of rural residents who are not accustomed to more formal procedures.

Preliminary findings of a study being conducted in the Houston Standard Metropolitan Statistical Area suggest that taxes in the rural portions of Harris County have been held down as a result of the extensive annexations by the City of Houston which more than doubled its land area between 1950 and 1960. The burden of providing urban services to these urbanizing territories was assumed by the city government rather than the county. Harris County has more cows than does any other county in Texas.

A pilot study in Minnesota of townships as a transitional form of government in urbanizing areas was completed during the year, and the results are being prepared for publication. While the township as a form of government is generally declining in importance, there are throughout the Midwest a number of townships on metropolitan fringes that have incorporated as villages. The Minnesota study suggests that many of these incorporations have been made in order to forestall fragmentation of the township through small incorporations and annexations, with the town officials often taking the lead in the incorporation. The township organization may, therefore, have served a useful role in helping to prevent fragmentation and promoting units which, when fully settled, might have a population of 50,000 to 150,000. Such units probably can realize most of the available economies of scale. Since the time when most of these townships were incorporated, Minnesota has established a Municipal Commission which controls nearly all incorporations and annexations on the rural-urban fringe. The study attempts a preliminary analysis of the Commission's role in the urbanizing areas.

A report on a related study in Los Angeles, California, discussed in last year's report, was published during the year, and one on Baton Rouge, Louisiana, is scheduled for early publication.

Work was begun on a summary report bringing together and evaluating the results of these and other recent studies of rural-urban fringe governmental problems.

Work continued on a study of the structure, functioning and financing of rural government in rural portions of the Upper Midwest. The study has developed extensive data on variations in costs of local government among counties of Minnesota, and several manuscripts have been prepared on this phase of the work. Basic information on local government has also been gathered for the States of North Dakota, South Dakota, Wisconsin and Michigan. The plan is to produce a report describing the way local government works in rural portions of these States, to analyze the problems rural communities face in providing and financing needed public services, and to compare the alternative approaches to solving these problems.

During the year, the staff cooperated informally in an Iowa State University study of local government services and finances in Iowa. The study is attempting to analyze local government costs and service levels, particularly in the field of education, and to determine the incidence of taxes levied in the State.

Preliminary work was done on a study of the effects of sparse and declining population on local government needs and resources in North Dakota. The purpose of the study is to provide clearer indications than are presently available of just what the effects of population decline are on needs for government services and on the means available for financing them.

Research was completed on a study of fiscal problems of rural areas experiencing continued outmigration of population, and a report prepared for publication. The study covered 10 counties in Southern Iowa and Northern Missouri. Fiscal problems of the Iowa counties were found to result from heavy local welfare costs, in conjunction with a stringent tax limit for this purpose. In Missouri, constitutional limitations on the tax rate for the general county fund have created difficulties for counties in keeping abreast of rising costs.

Research on cooperation between rural local units of government in Indiana, Wisconsin, Nebraska, Pennsylvania and Alabama, being carried out under contract by the Bureau of Government Research of Indiana University has been completed, and the final reports are nearly completed. An article on cooperation among rural governments was published in the 1963 Yearbook of Agriculture. An annotated bibliography was published during the year, and case studies were published by the Indiana State Library Association and by Indiana University. A report on interlocal cooperation in the State of Alabama is in process of publication by the University of Alabama Press, and interest has been expressed in university publication of State reports in Indiana and Pennsylvania. Findings to date indicate that interlocal cooperation is most likely to occur between local governments when revenue resources are adequate, or when State or Federal grants are available, or when a buyer-seller relationship exists in which one local government sells a service to one or more other local units.

Short summary articles delineating current problems of local government and of the finances of local government by staff members were published in the 1963 Yearbook of Agriculture, which was devoted to problems of rural-urban adjustment.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Estimates of Amount and Incidence of Farm Taxes

Farm Production Economics Division. 1963. Farm real estate taxes, recent trends and developments. ERS, RET-3. 15 pp.

Great Plains Agricultural Council. 1963. Adapting tax systems to Great Plains conditions. Montana Agr. Expt. Sta. Bul. 581. 44 pp.

Heneberry, W. H., and Spitz, R. G. F. 1963. Burden of property taxes on Illinois agriculture. 1963 Report of the Commission of Revenue, State of Illinois, pp. 492-505.

Shapiro, H. 1964. Farm personal property taxes, 1957-62. ERS-176. 21 pp.

Shapiro, H. 1964. 1964 Revenue Act--provisions of significance to farmers. ERS-165. 9 pp.

B. Assessment and Methods of Assessing Farm Property

Stocker, F. D. 1964. Urban encroachment in relation to farm taxes. Jour. Soil and Water Conservation 19(3), pp. 95-97.

Stocker, F. D. 1963. Taxing farmland in the urban fringe. Jour. Farm Econ. 45(5), pp. 1131-1137.

Stocker, F. D. 1963. The taxation of farmland. The Yearbook of Agriculture, pp. 158-166.

C. Organization and Finance of Local Government

Crouch, W. W. and Giordano, R. N. 1963. The example of dairy valley. The Yearbook of Agriculture, pp. 491-498.

Crouch, W. W., Goldsmith, J., and Giordano, R. N. 1964. Agricultural cities: paradoxes in politics of a metropolis. University of California at Los Angeles. 74 pp.

Hein, C. J. 1963. Problems of local government. The Yearbook of Agriculture, pp. 249-253.

Hein, C. J. 1963. Meeting unfilled public service needs in rural areas. Jour. Farm Econ. 45(5), pp. 1147-1149.

Press, C. and Rice, R. 1963. Rural residents and urban expansion. ERS-132. 18 pp.

Shapiro, H. 1963. The finances of local governments. The Yearbook of Agriculture, pp. 260-267.

Stoner, J. E. 1963. Cooperation among units of governments. The Yearbook of Agriculture, pp. 278-284.

Stoner, J. E. and Siffin, C. F. 1964. A selected bibliography on interlocal governmental cooperation. U. S. Dept. Agr. Misc. Pub. 958. 40 pp.

AREA NO. 7. FARMLAND VALUES AND VALUATION

Problem. Farm real estate is the largest single productive asset in agriculture and has a current market value in excess of $150 billion. Trends in market values of this asset, and reasons for such changes, are of continuing interest to land owners, prospective farmers, industries serving agriculture, local governmental units and Federal agencies. Both Federal and commercial lenders need current information as to the numerous economic forces affecting past and present trends in market values as a basis for formulating and modifying their credit policies. Farm programs often have widespread and pervasive effects on land values.

The widening disparity between land values and farm income that has developed in the past decade contributes further to the need for more intensive research regarding the basic determinants of land values and their probably future trend. Market values of agricultural lands have become increasingly responsive to numerous forces in the nonfarm sector, especially the upward trend in the general price level, population growth, and rising per capita incomes of the nonfarm population. Within the agricultural sector, the dominant forces appear to be the pressures on farm size associated with rapid technological change, the generally abudnant supply of credit available to finance land purchases, and restricted offerings of land for sale. Realistic projections of future trends and levels of land prices, which are essential in developing useful models of the prospective capital and credit structure of agriculture, will require more intensive study of the numerous forces both within and outside the agricultural sector.

USDA AND COOPERATIVE PROGRAM

The work involves a continuing program of applied research designed to obtain current information on various aspects of the farm real estate market at the State and national levels. Statistical series are developed and maintained to measure periodically changes in market values of farm real estate, rates of farm transfers by various methods, sources and terms of credit used in financing land transfers, and the sources of the demand for, and supply of, farmlands that come on the market. Two mail surveys are directed annually to farm real estate brokers and other informed people to obtain such basic information. National samples of actual sales of farmlands for agricultural purposes, and for nonfarm purposes, as well as a sample of farms and tracts offered for sale are obtained from the periodic surveys. These data, together with the responses to various opinion questions, and the estimates of market values obtained from USDA crop reporters, are summarized and analyzed in periodic reports issued 3 times a year.

Various special studies also are undertaken pertaining to specific aspects of the farm real estate market such as the valuation of farm buildings, installment land contracts, and costs of transferring farm real estate. Efforts to obtain estimates of market values of major classes of land in California, Florida, Texas, and other States have continued. Periodic analysis also is made of historical and current relationships between land values and various measures of farm and land earnings.

The national research program is supplemented with cooperative studies with State experiment stations designed to examine specific aspects of the farm real estate market in greater depth than is possible at the national level. The most recent study of this kind involved detailed analysis of nearly 16,000 sales of farm real estate in Illinois.

Estimation of gross and net rents paid for rented land is another continuing research project at the national level. Such estimates are needed in calculating net income of farm operators by the Department of Agriculture and in the national income accounts of the Department of Commerce. Rents also provide an important independent measure of the rates of return to farmland and a useful analytical tool in the continuing study of land prices.

About 2.1 Federal professional man-years are currently devoted to all phases of the research program in farmland values and valuation. Of this total, about 1.3 man-years were used on the current market developments phase of work, and 0.4 man-years on analysis of factors affecting land values and transfers. Lack of resources limited work on farm real estate rentals to 0.1 man-years, while 0.3 man-years was devoted to program leadership.

PROGRAM OF STATE EXPERIMENT STATIONS

The State Agricultural Experiment Stations carry on periodic studies of land sales and prices to determine the level of current prices, trend in prices, the relationship of various economic factors to the level of land prices, and the volume of transfers. Many of these studies are designed to show trends and levels for major portions of the State, whereas others are designed to shed light on specific problems such as the effect of partial takings of farm real estate for highways and the effect of crop allotment programs on the price of land used for such crops. A total of 1.9 professional man-years was devoted to this area of research.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Current Developments in the Farm Real Estate Market

Market values of farm real estate advanced 6 percent in the year ended July 1, 1964, and 3 percent in the March-to-July period. The gain for the year ended this July was the same as a year earlier but a little

larger than in the 12 months ended March 1, 1964. The national index of average value per acre as of July 1 was 135 (1957-59=100), a record high.

The total market value of farm real estate was estimated at $155 billion on July 1, 1964, up $7.3 billion from a year earlier. Because of fewer farms, the average value per farm at $49,300 was 8 percent above a year earlier. Per-farm values on March 1, 1964 ranged from a low of $14,000 in West Virginia to a high of $404,000 in Arizona. Five other States had per farm values in excess of $100,000.

Voluntary transfers of farm real estate occurred at the rate of 29.6 per 1,000 farms in the year ended March 1, 1964, about 4 percent higher than in the previous year. Offerings of land for sale remained at the generally low level of previous years but demand was somewhat stronger than a year earlier in the spring and winter wheat areas and in the central and western cotton areas. An ample supply of farm mortgage credit at steady interest rates prevailed in most parts of the country.

New information was obtained in the March 1964 survey pertaining to the methods used to sell farm real estate, commission rates charged by brokers, and various other costs involved in transferring farm real estate. About half of all sales were reported to be made through brokers, nearly 40 percent were handled directly by seller and buyer, and 12 percent were sold by public auction. Brokers' commission rates for selling farm property were typically 5 percent, but ranged upward in the Southeast. Rates charged for selling unimproved land were usually higher than for farms and rural residential property. The cost of preparing an abstract of title was paid by the seller in most areas of the country, whereas the costs of title search and insurance were more often a cost of the buyer.

Imputed returns on the market value of farm real estate were estimated at 5.2 percent in 1963, down slightly from a year earlier but equal to the 1960-63 average. The decline in the proportion of total net income allocable to farm labor because of fewer farms and fewer farm workers has been the most important factor sustaining the imputed returns to land, despite the continued rise in market values. Returns to land would be about 1 percent less than presently calculated if allowance was made for a return to management.

B. Analysis of Factors Affecting Land Values and Transfers

The analysis of 16,000 farm sales in Illinois showed that the average acreage transferred was only half that of the average size of farm in the State. Most of the tracts transferred were bought to enlarge farms and would not be farmed as independent units. Three-fourths of the sales had buildings, however, suggesting that they had been complete farms at some time in the past. Land with buildings had an average sales price 15 percent higher than land without buildings, whereas tax assessors allocated

22 percent of the total value to buildings. For parcels of 40 to 80 acres, nearly the same prices were paid whether or not the land had buildings.

Smaller tracts were sold for higher prices per acre than larger tracts. A part of such differences can be attributed to the higher proportion of pasture and other noncrop land contained in the larger tracts, but there was also some evidence that the better land was more often divided into small tracts to facilitate sale. There was no evidence that higher prices were paid solely because it was divided into smaller plots.

Average sales prices of land without buildings ranged from as low as four time the value of crop output in the less productive areas of the State to eight times the value of a year's crop production in central Illinois. Increases in sales prices between 1952 and 1957 were largest in the low-valued areas. To some extent, this represented a catching up in values to a more normal relationship with farm earnings, whereas in the most productive areas, land prices were already high in relation to earnings at the beginning of the period.

Another study of land prices and farm income relationships at State and National levels showed that market values advanced 67 percent more than net farm income between 1951-53 and 1961-63. The relative increase was a little less than the national average in the Corn Belt and Northern Plains States, but substantially greater than average in the Northeastern and Mountain States. Price-income ratios for the various States in 1961-63 were at the highest level in nearly 3 decades. The national ratio of 9.5 was the highest since 1933.

Despite the lack of farm income support for the increase in land prices, 86 percent of the variation in land prices among States in 1961-63 was associated with State differences in net farm income. A regression analysis showed that a difference of 10 percent in net farm income per acre among States was associated with a difference of 7.5 percent in the market value of farm real estate. States having land prices substantially higher than would be indicated by farm income are chiefly those where nonfarm influences have been especially strong.

C. Agricultural Rents

Gross rents were tentatively estimated at $3.7 billion in 1963, about 4 percent higher than in 1962. Most of this increase was attributable to the higher value of crops paid as share rent, although cash rental rates also were higher. Landlords' expenses also increased, but net rents showed a slight advance. Net rents have been 3.6 percent of the current market value of rented land in each of the last 3 years.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Current Developments in the Farm Real Estate Market

Farm real estate market developments. CD-65, April 1964. 27 pp.

Farm real estate market developments. CD-66, Sept. 1964. 45 pp.

Gale, J. F. 1964. Installment land contracts in financing farm real estate transfers. Agricultural Finance Review, Vol. 25, pp. 37-44.

B. Analysis of Factors Affecting Land Values and Transfers

Dovring, Folke and Scofield, W. H. 1963. Farm real estate sales in Illinois. Ill. Agr. Expt. Sta. Bul. 697. 48 pp.

Scofield, W. H. 1964. Land prices and farm income relationships. Agricultural Finance Review, Vol. 25, pp. 13-22.

C. Agricultural Rents

None.

AREA NO. 8. ECONOMICS OF FARM PRACTICES AND TECHNOLOGY

Problem. New and rapidly changing technology is having profound effects on agriculture. Ever-changing conditions of production brought about by new machines, new-type structures and related equipment, and improved methods of crop and livestock production require continual economic study to provide farmers, policy makers, and industries serving agriculture with guidelines for decision in a changing economic environment. Such studies need to measure and keep abreast of major changes in farming technology and must appraise the implications of these changes for the future. These studies should include analyses to provide information needed by farmers in different situations as they adjust to changing conditions of technology, prices, and costs. They should also include analyses aimed at guiding policy makers and program administrators as well as at helping industry to meet better the needs of farmers.

USDA AND COOPERATIVE PROGRAM

This is primarily applied research, consisting of a continuing program of collection and analysis of data bearing on national situations and of the study of certain important innovations in farm practices and technology. Included is the development of aggregative measures of the effects of technological changes on farm output, costs and income.

More specifically, the work involves the collection of pertinent data and the economic analysis of developments in farm mechanization and structures, in the use and effects of fertilizer and related crop practices, and in the production and utilization of livestock feed. These activities center in Washington, D. C. and consist mainly of broad national studies dealing with both the supply aspects and the demand aspects. They usually involve at least informal cooperation of other USDA agencies, particularly the Statistical Reporting Service and the natural science and engineering groups dealing with mechanization, crop practices, and livestock feeding. Research results are normally presented in aggregative terms for areas, States, or regions, along with supporting data such as input-output ratios. Intensive studies of narrower scope are made occasionally in selected areas to obtain information to supplement national and regional data from other sources. Such studies are usually in cooperation with State experiment stations, currently in Iowa and Michigan.

The manpower currently devoted to this program is estimated at 9.3 Federal professional man-years, with 1.0 in program leadership, 1.7 on economics of farm mechanization and associated techniques, 1.3 on economics of farm structures and materials handling, 2.0 on economics of fertilizer use and crop technology, 2.0 on economics of feed use and feed-livestock relationship, and 1.3 on inventory of production practices. A research contract

was entered into with Iowa State University in June 1963 for a survey and certain analyses of the economics of farm service buildings. In Fiscal Year 1965 an estimated additional 4.3 professional man-years will be devoted to the economics of pesticide use in agriculture.

PROGRAM OF STATE EXPERIMENT STATIONS

The constant introduction of new equipment and methods of use necessitates continuing studies relative to farm practices and technology. Practically all aspects of the farm involve some form of mechanization. Sixteen States have studies classified under "farm equipment and structure--costs and efficiencies," some of which are being conducted in cooperation with agricultural engineers and production personnel. Studies of the costs of owning and operating farm machinery are being conducted in each region of the country. Regional project W-62, The Cost of Owning and Operating Farm Power and Machinery Used for Seed-bed Preparation and Tillage, is now closed but some of the contributing projects have been continued exploring leads. Studies relative to suitable equipment for harvesting and handling are also being made. Two studies of the relative profitability of different irrigation equipment and practices are being conducted. A total of 6.7 professional man-years are devoted to this area of work.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Economics of Farm Mechanization and Associated Techniques

Research is in progress on the aggregate demand for farm machinery. At present, this work is limited to farm tractors for different regions and for the Nation as a whole. Various economic models were tested for their effectiveness in explaining the past demand for tractors and for their ability to estimate future changes. Investigations included the applicability of recursive programming procedures, Markov processes, logistic patterns of growth, and regression analysis for describing the demand for farm tractors. With the available information, the regression analysis provided a good description of past purchases of tractors and reasonable estimates of changes in numbers and purchases in the immediate future. Several recursive programming procedures were investigated but discontinued because of the extremely large amount of data required for the analysis of one input.

Projections made with the Markov process indicate 1/2 to 1 1/2 million more units on farms for 1980, depending on the specific projection model used. These projections of tractor numbers on farms in 1980 are too high. Purchases between 1964 and 1980 would need to be about twice their current levels in order to have a million more tractors on farms in 1980, using the present schedule for discards of old tractors.

The logistic equation (growth curve) fitted to the data of tractor numbers on farms fits the data well for past years. However, the use of this equation for projections into the future has limited value. It indicated that tractor numbers on farms would increase to more than 6 million when the most recent data are included. The projected number to any point in the future depends much on the years used to describe the past. As more years are used as a base for making projection of future growth in tractor numbers, the top of the growth curve increases.

The use of multiple regression to study the demand for farm tractors included both time series and cross-sectional analyses. Time series aggregative data were available from 1920 to date. They provided useful estimates of the contribution of the factors related to tractor purchases. The data used for a cross-sectional analysis were available for only one year; but will be available annually in future years. In the study using time series data, the number of tractors already on farms, crop production, price of tractors, prices received for products sold, size of tractor purchases, age of tractors on farm, and the number of farms explain more than 90 percent of the variation in tractor purchases from 1920 to 1962. The regression coefficients were significant in most cases. The significance varied with different specifications of the problem. Projected purchases ranged from 3 1/4 to 9 million horsepower for 1970 when all independent variables were included--first at their lowest estimated values for 1970, and then at their highest values. A narrower and more realistic variation in purchases, from 6 to 8 million horsepower, results from a slightly different specification of the problem. Actual purchases for 1970 are estimated to be about 8 million horsepower or almost the same as in 1962. This estimate is based largely on past experience which has shown that actual quantities have equaled or exceeded the more optimistic projections of many economic variables.

B. Economics of Farm Structures and Materials Handling

Research is in progress on the economics of farm service buildings, at Iowa State University under a contract signed in 1963. The objective is to analyze the enumerative data from a sample of 300 Iowa farms to obtain results for the Western Corn Belt and to develop methodology that can be applied to broader regional and national studies of the demand for farm buildings. The research is aimed at determining the factors involved and the quantitative effects of these factors upon the investment in farm buildings.

C. Economics of Fertilizer Use and Crop Technology

Exploratory effort on development of fertilizer-yield coefficients for use in aggregative analysis has been completed preparatory to extension of the work for Nation-wide coverage of major crops, by State parts or agricultural sub-regions. Crop yield responses to fertilizer furnished by State specialists are used to estimate economic potentials of fertilizer

use and yields, as well as economic minimum rates of application based on knowledge of production costs other than fertilizer. Estimates of yield response to fertilizer are essential in furnishing a dynamic, rather than a purely statistical, basis for appraising the demand for fertilizer. They also supply needed coefficients for use in programming models, both local and national in scope.

For the Corn Belt and Lake States, preliminary estimates indicate that current rates of application on corn may be higher than needed for minimum unit cost, but only two-fifths of economic maximum (most profit per acre) rates at present levels of other technology. The 1963 average corn yield per fertilized acre was 82 bushels. But with improved other technology, 1963 average rates of application (55-48-43 lbs. of N, P_2O_5 and K_2O) would result in an average yield at 101 bushels, a level attained or exceeded by many farmers.

In the 8 Corn Belt and Lake States, with 1954=100, the index of rates of application of principal plant nutrients in 1963 stood at 261 for N, 170 for P_2O_5 and 155 for K_2O. Based on preliminary estimates of yield response, nearly half (48 percent) of the increase in yield, 1963 over 1954, can be attributed to increased rates of application per acre. The remainder (52 percent) was due to other causes including use of fertilizer on more acres, other improvements in technology, weather, and weather-technology interactions. Compared with "normal", other sources indicate a weather index at 94 for 1954 and about 105 for 1963. In these 8 States, average rates in pounds per acre for most profit per acre for 1963 conditions are 215 N, 74 P_2O_5, and 102 K_2O for a yield of 118 bushels. But with improved technology associated with yields now being obtained by many farmers, preliminary estimates of response indicate rates of 250 N, 85 P_2O_5, and 116 K_2O for most profit per acre and a yield of 153 bushels at these rates. This is based on $1.00 corn and prices per pound of $0.114, $0.097, and $0.052 for N, P_2O_5 and K_2O respectively.

These results suggest the dimensions of economic potentials with more widespread adoption of known technology. They also suggest elements for inclusion in models used in aggregative supply analysis, and analysis of demand for production inputs, including profitable input substitution.

<u>Progress on a pilot study of effects of changes in technology on optimum farm size and organization for specified income levels in the Georgia Piedmont</u> reflects inclusion of tree planting and woodland improvement activities in the model. Using the current statistical definition of a minimum net income to avoid "poverty", a one-man crop-beef operation to provide a $3,000 income would require 210 acres of which 13 would be in pine tree plantings and 150 acres in improved woodland. The remaining 47 acres would be available to support 50 calves and to use for crop production. By comparison, maximum net income for a one-man operation would be $10,000, requiring 875 acres of land including 730 acres suitable only for farm

forestry. Grazing to support 150 calves would require 110 acres and 35 acres would be used for a 3-year rotation of corn and Coastal Burmudagrass.

Research on the aggregative demand for fertilizer was initiated in Michigan in 1963. Commercial fertilizer, as one of the major inputs in the production of farm crops, has been increasing in importance both absolutely and relative to other inputs in recent years. As a percent of total inputs on commercial farms, fertilizer consumption has doubled during the period 1947-49 to 1960-62 with the increase greater in some regions of the country than others. Concurrent with this increase, the average cost per unit of plant nutrient has been declining, due primarily to the increased use of high analysis materials. The objective of this research is to determine the structural forces that have induced changes in the use of fertilizer. This research will attempt to explain the relationship of fertilizer to the other inputs in agriculture and to farm income, price of crops and other related factors.

D. Economics of Feed Use and Feed-Livestock Relationships

Research is carried on at the national level to determine the effects on feeding efficiency of current and new technology in livestock feeding and management. The data have been revised and updated through the 1964-65 feeding year. These studies show that the very high feed consumption and feeding rates which prevailed from the feeding year 1957-58 through 1961-62 for hogs and cattle on feed have turned downward in 1962-63 and 1963-64. High feeding rates continue to increase for milk cows per head. Little change is noted in feeding rates for other classes of livestock. Numbers of grain-consuming animal units and high protein animal units have declined somewhat. Roughage-consuming animal units continue to increase in numbers, because of the rapid increase in beef cattle numbers. Feed grain-livestock balances by States have been updated through 1963-64. Similar hay-livestock balances have been calculated through 1963-64. Studies of feed consumption have been continued to determine feeding rates for various kinds of livestock in each of the States. Field work has been completed in about 35 of the States. Preliminary computations are underway.

Research on economic evaluation of pasture production was completed and a manuscript is being prepared. A sample of sixty-four farms were enumerated in Susqehanna County, Pennsylvania. Farmers provided estimates of livestock production obtained during the grazing season, quantities of concentrates and harvested roughages fed to livestock while grazing pastures, and the acres of pasture found on each farm by general types. This information was used to evaluate the feasibility of enumerative data as a basis for improving the estimates of the contribution of pasture to livestock production. The findings indicate that estimates of support from grazing lands to livestock production based on enumerative data are similar to those obtained by residual techniques currently being used.

E. Inventory of Production Practices

Preliminary results from a national survey of methods of harvesting hay in 1961 show an increase in the proportion of the crop that was field baled, from 73 percent in 1954 to 83 percent in 1961. Chopped hay remained at about 7 percent while that handled in long loose form declined from 20 to 11 percent. Two-thirds of the baling was done by the farmer with his own baler while one-third was done by custom operators or by other arrangements. Balers equipped with bale throwers accounted for 3 percent of the baling of hay. An estimated 160,000 crimpers and crushers were used to field condition 22 percent of the total hay crop in 1961. Only 2 percent of the total tonnage was dried artificially.

Tabulations were made for a few items in selected States in a national survey of forage handling which covered 1963 crops. The States selected were those having 100,000 tons or more of grass silage in the 1959 census and those where high moisture corn was stored in silos. Regions and States included were: Northeast, (except New Jersey and Delaware) Lake, Corn Belt, Pacific, and South Dakota, Nebraska, and Virginia. One of the important discoveries was the quantity of green feeding or green chop being fed. Previous fragmentary data had indicated little tonnage involved. However, by 1963 some States were feeding more green chop than grass silage. Green chop amounted to about 10 million tons in the selected areas while grass silage was about 12 million tons. This tonnage of grass silage compares with 8 million harvested in 1959.

In the Corn Belt, Lake States, South Dakota, and Nebraska about 90 million bushels of high moisture corn was stored in silos in 1963. This amounted to about 2.5 percent of the corn harvested for grain in those States.

F. Economics of Pesticide Use in Agriculture

As part of the Department's expanded research program on pesticides provided for by the Congress for Fiscal Year 1966, The Farm Production Economics Division will initiate a new program of research on the economics of pesticide use in agriculture. This research will be divided into three major phases: (a) A Nation-wide survey of farmers to obtain basic data on practices used to control plant and animal pests, costs of these practices, and the use of toxic chemicals; (b) analysis of selected alternative methods of pest control with emphasis on comparative costs and returns; and (c) analysis of the economic implications of alternative methods of control both on the farm and for agriculture as a whole. Planning for the Nation-wide survey, the first phase to be undertaken, is well under way.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Economics of Farm Mechanization and Associated Techniques

None.

B. Economics of Farm Structures and Materials Handling

Scott, Jr., John T. 1964. The measurement of technology. Jour. Farm Econ. 46(3), pp. 657-661.

C. Economics of Fertilizer Use and Crop Technology

None.

D. Economics of Feed Use and Feed-Livestock Relationships

Andrilenas, Paul A. 1964. Economic aspects of specific pathogen free hog production. ERS-142. 14 pp.

Hodges, Earl F. 1963. Livestock-feed relationships, 1909-1963. Stat. Bul. 337. 49 pp.

Hodges, Earl F. 1964. Consumption of feed by livestock, 1940-1959. Prod. Res. Rept. No. 79. 94 pp.

E. Inventory of Production Practices

Ibach, D. B., Adams, J. R., and Fox, E. I. 1964. Commercial fertilizer used on crops and pasture in the United States-1959 estimates. Stat. Bul. 348. 201 pp.

Strickler, Paul E. and Harrington, Burton J. 1964. Liquid petroleum fuel used by farmers in 1959 and related data. Stat. Bul. 344. 20 pp.

AREA NO. 9. FARM COSTS AND RETURNS

Problem. In this period of rapid change in American agriculture, it is important to have comprehensive, reliable current and historical data on representative or typical farms in major commercial farming areas of the U. S. Physical and economic data needed include: farm size, land use, livestock numbers, production, investment, prices received and quantities sold, prices paid and quantities purchased, and net returns. Such information is essential for intelligent policy and operating decisions by the agencies and industries serving agriculture and by farmers themselves.

USDA AND COOPERATIVE PROGRAM

The work on costs and returns by major types of farms is a continuing study of operations of typical or representative commercial farms to determine changes in size of farm, organization, investment, productivity, receipts, expenses, net farm income, physical inputs, farm output, prices received for products sold, and prices paid for goods and services used in production. Budgets are prepared annually to provide current information. Estimates for earlier years are revised as new information becomes available. Analyses are continually underway to show the effects of economic and technical changes on land, labor, and capital requirements, production, production efficiency and incomes of typical or representative commercial farms. Nearly all the work is done in Washington with informal cooperation with States where the studies are located. Formal cooperation is maintained with the Kentucky and Iowa Experiment Stations and is being developed with several others.

A total of 9.0 Federal professional man-years were devoted to all costs and returns work, with 0.7 devoted to program leadership and 8.3 devoted to costs and returns by major types of farms.

PROGRAM OF STATE EXPERIMENT STATIONS

Farm costs and enterprise studies constitute a significant portion of the research program in farm management. The wide range of conditions being studied with the view of increasing efficiency, reducing costs, and improving income can be but briefly summarized in the space allotted. Thirty-five States have one or more projects in this general area. Input-output data for the various crops and enterprises under the wide range and conditions that exist are not only essential in providing information needed in decision-making on the part of the farm operator, but such data are used in some of the analyses discussed in other sections of this report. As should be, some of the studies are conducted in cooperation with other departments at the Station because it has become increasingly recognized that findings of the biological and physical scientists have little value to farmers if the results have not been

tested for economic feasibility. Some work is concerned with job analysis. Complete systems of forage handling have been synthesized and models designed, resulting in efficient use of labor, buildings, and equipment. Further cost reduction opportunities continue to be sought. Marginal rates of substitution between roughages and concentrates for specified cow abilities and production levels have been determined. Likewise, least cost rations for selected livestock enterprises are being conducted. A total of 39.3 professional man-years are devoted to this area of work.

PROGRESS -- USDA AND COOPERATIVE PROGRAMS

A. Costs and Returns by Major Types of Farms

Estimates for 1963 bring up to date the continuing series on costs and returns of typical commercial farms in the major producing areas in the United States. The report for 1963 covered 40 types of farms, one more than in the previous year. The one added is for typical broiler producers in Northern Georgia operating under contract and producing from 10,000 to 60,000 broilers annually. In addition, the historical series for three farm types--irrigated and nonirrigated cotton farms in the High Plains of Texas, and the peanut-cotton farms in the Southern Coastal Plains--were revised using data from enumerative field surveys and census schedules.

Estimates of costs and returns were completed for contract broiler operators in Delmarva who have no crop enterprises but obtain part of their income from off-farm employment. These operators produced an average of 27,500 birds in 1957, increasing to 49,900 in 1963. Net farm income increased from $865 per farm in 1957 to $2,240 in 1963. Seventy percent of the operators received income from off-farm work in 1963 ranging from $280 to $5,700 per farm. In 1963, income from off-farm employment averaged $3,270 per farm, making a total return of $5,510 from broilers and off-farm employment.

At the request of the Kentucky Agricultural Experiment Station, cooperative work was initiated on a study of typical commercial farms producing dark air-cured and dark fire-cured burley tobacco in the Pennyroyal area of Kentucky and Tennessee. This important tobacco producing area comprises approximately 7 counties in southwestern Kentucky and 6 counties in northwestern Tennessee. Data on farm size, land use, livestock numbers, and related characteristics from the individual farm questionnaires of the 1954 and 1959 censuses were summarized. Data on tobacco acreage and production, and the prices paid to producers for 1961, 1962 and 1963, were tabulated from ASCS records.

Enumerative field surveys were made on tobacco-livestock farms in the Bluegrass area of Kentucky, small and large-scale cotton farms in the Delta of Mississippi, grade A and grade B milk producers in the eastern Wisconsin dairy area, hog fattening--beef raising farms in southern Iowa, northern Missouri, and west central Illinois, and contract broiler farms in the Delmarva area. These surveys were made to update information with primary emphasis on the kinds, quantities and prices of fertilizers and pesticides used by crop; the purchase, use of and expenditures for machinery; expenditures for buildings and equipment; management practices; capital investment; and debt structure.

Data on off-farm income obtained in the enumerative surveys indicate that many operators have adjusted their operations to take advantage of off-farm employment. As these data accumulate they will help to explain why and how farmers adjust their operations to economic stimuli.

In 1963, net farm income per farm ranged from $745 on typical contract broiler farms in Georgia to $96,400 on typical large cotton-general crop farms in California. These farms also had the lowest and highest returns in 1962.

In 1963, net farm incomes were higher than a year earlier on 18 of the 40 types of farms, were the same on 7 farm types, and were lower on 15. The change in incomes from 1962 to 1963 on the 40 farm types ranged from a decrease of 65 percent on hog-beef fattening farms in the Corn Belt to an increase of 37 percent on Black Prairie cotton farms. This shows the economic difficulty beef feeders face when they pay high prices for feeder calves and sell them at low prices after they are fattened. Cotton farmers generally had a fairly good year in 1963 with most of the operators showing substantial increases in returns from a year earlier. Wheat farmers,on the other hand, all received lower returns in 1963, chiefly because of lower prices received for wheat.

The ratio of prices received to prices paid in 1963 generally continued unfavorable to farmers, but increased production in many cases offset this. Index numbers of prices received for products sold on the 40 types of farms averaged slightly lower in 1963 than in 1962 and 3 percent below the recent 10-year, 1951-60 average. Prices paid continued to rise and were approximately 9 percent higher in 1963 than the 1951-60 average. On the other hand, production per farm continued upward and averaged nearly 5 percent higher than in 1962, and 34 percent higher than in 1951-60. Both farm size and output per acre are increasing.

On the 18 farms having higher incomes in 1963, 16 had larger production and 13 received higher prices for their products. On 17 farms having lower incomes in 1963, 16 received lower prices. Thirty-one of the 40 types of farms studied, had higher operating expenses in 1963 than in 1962.

Net farm incomes in 1963 were above those of the 10-year period, 1951-60, on 33 of the 40 types of farms. All of the livestock ranches (cow-calf operations), dairy farms, and tobacco farms had higher incomes than in 1951-60. Higher incomes ranged from 2 to 107 percent above the 1951-60 average, and lower returns ranged from 6 to 50 percent below the 10-year average.

Work continued on analysis of production response to alternative prices and commodity programs on farms in the Southern Coastal Plains, using data from the costs and returns series for peanut-cotton farms. A modified recursive programming model is being constructed to simulate the production behavior of Southern Coastal Plains farms. A procedure for grouping farms to minimize aggregation bias is being tested.

A study of costs of owning and operating farm machinery on different sizes of farms in northwestern Ohio has been completed and published. The three sizes of farms studied averaged about 80, 160, and 320 acres of total farmland; all farmers received the major part of their farm income from the sale of crops; and all worked off their farms less than 30 days during the crop production season of 1960. Total costs of owning and operating tractors and 13 kinds of major implements averaged a third lower per acre on the large farms than on the small farms. These costs included costs of the implement, the tractor, and driver. Costs were highest on the smaller farms mainly because of lower annual use of machines, and older and smaller machines that required more driver time per acre and had higher repair costs per acre of use.

The annual Outlook issue of the Farm Cost Situation was published in November 1963. (The Spring issue has been discontinued.) The report summarizes significant current developments in the use and cost of the major groups of input items. It also contains a summary of costs and returns on 8 selected types of farms (reported in previous Outlook issues) across the country. The November 1963 issue indicated continued increases in farm production expenses for 1964, continuing the long-term trend of taking a greater percentage share of gross farm income. During recent years, cost rates or prices paid for three major groups of input items--motor vehicles, farm machinery, and hired labor--have increased at a faster rate than most other input items. Prices paid in 1963 for fertilizer, building materials, farm supplies and livestock remained at about the 1957-59 average. Interest and tax payments per acre in 1963 were respectively 62 percent and 39 percent higher than in 1957-59.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Costs and Returns by Major Types of Farms

Brown, W. H., Lee, J. E., Jr. and Hole, E. 1964. Costs and returns, commercial cotton farms, 1963. FCR-20. 13 pp.

Cummins, D. E. 1964. Costs and returns, commercial dairy farms, Northeast and Midwest, 1963. FCR-22. 9 pp.

Economic Research Service. 1964. Net returns up on grade B Wisconsin and grade A northeast typical dairy farms, 1963. Dairy Situation (August 1964) DS-302, pp. 24-26.

Economic Research Service. 1963. The farm cost situation. 1964 Outlook issue. FCS-35. pp. 34-43

Goodsell, W. D. and Gray, J. R. 1964. Costs and returns, western livestock ranches, 1963. FCR-18. 10 pp.

Goodsell, W. D. and others. 1964. Farm costs and returns, commercial farms, by type, size, and location. AIB 230 (revised). 93 pp.

Hurd, E. B. 1964. Costs and returns, commercial wheat farms, Pacific Northwest, Northern Plains, and Southern Plains, 1963. FCR-21. 12 pp.

Rosenberry, P. E. 1964. Costs and returns, commercial Corn Belt farms, 1963. FCR-24. 5 pp.

Shugars, O. K. 1964. Costs and returns, commercial tobacco farms, Coastal Plain, North Carolina, 1963. FCR-19. 9 pp.

Shugars, O. K. and Bondurant, J. H. 1964. Costs and returns, commercial tobacco-livestock farms, Bluegrass area, Kentucky, 1963. FCR-23. 9 pp.

Stoddard, E. O., II. 1964. Costs and returns, commercial broiler farms, Delmarva, Maine and Georgia, 1963. FCR-26. 14 pp.

Stoddard, E. O., II. 1964. Costs and returns, broiler farms, Georgia. Poultry and Egg Situation, Jan. 1964. PES-229, pp. 14-21.

Stoddard, E. O., II and Carncross, J. W. 1964. Costs and returns, commercial egg-producing farms, New Jersey, 1963. FCR-25. 8 pp.

Vermeer, J., Hole, E. and Chugg, B. A. 1964. Costs of farm machinery in crop production in northwestern Ohio, by size of farm. ERS-175. 23 pp.

U.S. Department of Labor. 1963. Opportunities on specific types of farms. Occupational Outlook Handbook. Bul. 1375. pp. 732-737.

AREA NO. 10. FARM LABOR UTILIZATION AND PRODUCTIVITY

Problem. The utilization of human effort in farm production has changed greatly in recent decades and will likely change even more rapidly in the years to come. Technological and other economic developments increase the productivity of individual workers and make possible a decrease in the number of persons engaged in farmwork. But these developments require higher levels of skill and knowledge on the part of the persons continuing to do farmwork, while forcing other workers to seek nonfarm employment. At the same time, the increasing attractiveness of nonfarm jobs together with various social and economic changes exert upward pressures on earnings and perquisites in many types of farm employment. Because of the many economic, social, and other changes that affect the utilization of human effort in farm production, a better understanding of these changes is needed to assist in planning for and guiding the human and economic adjustments involved.

USDA AND COOPERATIVE PROGRAM

Work on farm labor requirements and use is carried on as a continuing program in Washington, D. C. This work is aimed at keeping abreast of farm labor used, nationally and by regions, in total and by major enterprises. Estimates of man-hours of farmwork are prepared annually, based on pertinent secondary data and, when necessary, by field surveys. This series of estimates, going back to 1910, gives a comprehensive statistical picture of what has happened to farm labor requirements over the years.

A continuing program of measuring and analyzing changes in farm labor productivity and efficiency is conducted in Washington, D. C. It provides annual indexes of farm production per man-hour, with breakdowns by regions and by major commodities. The series of estimates provide comprehensive measures of farm labor productivity over the years. Periodically, analyses are made of the past and projected future effects of technological and other developments on production per man-hour and on quantity of labor input used.

Research on the economics of farm labor utilization is conducted. Some of the important long-term developments in U. S. farming have been the substitution of capital for labor, the discovery and adoption of labor-saving technologies of production, and the substitution of skilled for relatively unskilled human effort. Research to understand these developments and the related farm-labor adjustments is for the most part done through special studies in selected situations. Some research is located in Washington, D. C. and some at field locations. Current projects are cooperative with the State agricultural experiment stations of California and Iowa.

The economic relationships between farm operators and hired farmworkers constitutes another line of study. In certain types of farming and geographic regions, hired farmworkers are becoming a relatively larger segment of the farm workforce. Economic relationships between farm operators and hired farmworkers are becoming more complicated and less determined by custom, with the basic character of these relationships also often changing. In addition to their other managerial functions, many farm operators are now of necessity exercising a personnel function in an employer-employee relationship. Such problems are involved here as: Seasonal peaks in labor requirements; the development of workers' skills; training of workers for particular jobs; management of workers; and determination of incentives such as the levels of wages and perquisites (including housing) and of the other terms and conditions of employment. Hired workers likewise find that they may face new or more difficult problems growing out of technologic displacement of old tasks, shifts in areas of production, longer and more frequent periods of unemployment during the year, and the necessity to learn new and more exacting skills and work habits. Research presently under way in this sub-area is cooperative with the Oregon Agricultural Experiment Station.

A total of 5.5 Federal professional man-years is devoted to this research area, distributed as follows: Program leadership, o.5 man-year; farm labor requirements and use, 1.2 man-years; farm labor productivity and efficiency, 0.8 man-year; economics of farm labor utilization, 2.1 man-years; and economic relationships between farm operators and hired farmworkers, 0.9 man-year.

PROGRAM OF STATE EXPERIMENT STATIONS

Research studies conducted at State Experiment Stations dealing with farm labor can be divided into two categories. In the first instance are studies designed to determine labor requirements and efficiencies for farm production and for the various tasks and functions which constitute total farm operations. In the second instance labor studies are concerned with aggregative aspects of labor supply, demand, and utilization.

Studies of the former type are being conducted to determine labor efficiency and cost of alternative feed handling methods on dairy farms; to determine the most effective work methods in the production of poultry, eggs, and vegetables; to analyze the processes involved in hog production in an effort to synthesize work elements into a least-cost system of production and to compare mechanical and hand methods of vegetable and fruit harvesting.

Labor studies of the aggregative type are underway in three of the four major regions. In the Midwest Region supply and demand functions are being estimated for operator, unpaid family and hired labor in agriculture. Studies are also being conducted to determine the impact of industrialization and nonfarm employment opportunities upon the transfer of labor out

of agriculture and to analyze the characteristics of the farm labor force which aids or hinders the labor transfers in an effort to develop more effective public and private policies to increase labor mobility. Studies in the West give emphasis to the effects of labor saving technology upon the quantity, types and seasonality of demand for farm labor. In the South labor research is concerned with the magnitude and significance of the farm labor surplus, the demand for farm labor in relation to current and future agricultural adjustments in the region and the quantitative and qualitative aspects of rural populations relative to employment opportunities in agriculture.

The total State effort devoted to farm labor research is 12.87 professional man-years of which 3.61 is for labor requirement and use and 9.26 is for farm labor supply, demand, and utilization.

PROGESS -- USDA AND COOPERATIVE PROGRAMS

A. Farm Labor Requirements and Use

The continuing research on labor requirements and use in farm production indicated that labor used on farms reached a new low of 8.8 billion man-hours in 1963. The decrease from 1962 amounted to 2.6 percent which was considerably less than the average rate of decline during the last decade.

Growing and harvesting crops in 1963 utilized 4.1 billion man-hours while work associated with the production of livestock took 3.5 billion man-hours. Crop production used 47 percent and livestock production 40 percent of the total labor input. The remainder--13 percent or 1.1 billion man-hours--was used for farm maintenance or overhead work. There has been a gradual decrease in the proportion of farmwork devoted to crops and an increase for livestock. Crop labor comprised 56 percent of the total in 1910 and work on livestock 29 percent. These changing proportions resulted chiefly from greater advances in mechanization of work on crops and from a smaller increase in total production of crops than of livestock. Counter to the trend, crops took a greater proportion of all labor in 1963 than a year earlier. Increases in crop output resulting from high yields and 6 million more acres of crops harvested in 1963 practically negated the drop brought on by declining man-hours per acre of crops.

Use of labor on farms in the Delta States rose about 7 million man-hours from 1962 to 1963, but it declined in all other parts of the country. Decreases in these regions ranged from less than 1 percent in the Southeast to 6 percent in the Northeast. Large increases in production of cotton and sugarcane were the significant factors interrupting the downward trend of labor needs in the Southeast and Delta Regions.

As secondary data were not generally available for estimating labor requirements for truck crops, primary data thereon were collected prior to the

current reporting period by a private research firm under contract. Interviewed were almost 2,500 growers who harvested almost 219,000 acres of truck crops in 12 major producing areas. Data collected included the amount and kind of labor used on each field operation, production practices, material inputs and costs, and contractual arrangements between producers and buyers. Analyses of these data, made by Division personnel, have been completed. Thirteen research reports have been prepared. Five of them were published during the reporting period; six were published earlier; two are in process.

B. Farm Labor Productivity and Efficiency

The continuing research on farm labor productivity and efficiency shows that farm output per man-hour rose in all parts of the country from 1962 to 1963. The national increase was 6 percent; it ranged from 3 percent in the Pacific Region to 10 and 11 percent in the Lake States and Corn Belt Regions, respectively. These regional gains in 1963 are not significantly different from annual changes during the last decade when farm production per man-hour more than doubled in four regions--Corn Belt, Northern Plains, Delta States and Southern Plains--and rose 43 percent in the Pacific Region. The differences among regions are largely accounted for by the kinds of crops and livestock produced and the varying progress made in mechanizing them.

The significant increase in production per unit of farm labor is also shown by another productivity ratio; that is, the number of consumers of farm products per farmworker. In 1963, the ratio was 1 worker to 31 consumers. This represented a near-record increase from the previous year and was 60 percent greater than the annual gain during the last decade. The additional consumers per farmworker in 1963 were about equally divided between domestic and foreign citizens. The latter are supplied through exports from the United States. On the other hand, an equivalent of around 10 percent of the U. S. population are fed and clothed with imported products.

C. Economics of Farm Labor Utilization

A project on labor and capital in selected crops and areas in California is underway in cooperation with the California Agricultural Experiment Station. The first area studied was Kern County and two reports, "Farm Workers in a Changing Agriculture" and "Cotton Mechanization and Labor Stabilization" were completed and are in process of publication. They indicate that a leveling off of seasonal labor peaks is taking place, and that in the near future from 5,000 to 7,000 workers would be able to do all the farm work in the county. This would mean that the seasonal workers would have to shift from one crop to another. At present the Mexican workers are the least specialized and the most likely to be able to remain in seasonal farm work. "Anglo" workers will be eliminated except for year round and other general farm work.

Field work for Stanislaus County, the second area for study, was divided into three phases; the first to cover the tomato, grape, and nut harvest in October; the second to cover peach thinning and berry picking in May; and the third to cover the peach harvest in September. These were completed in 1962 and 1963. The data have been coded, tables have been prepared, and the analysis is under way. Two reports are planned. The first will deal with the characteristics, employment, and earnings of the farm workers in the area. The second will deal more generally with the problem of specialization, seasonality, and the maintenance of a labor force. Maintenance of such a force for the fruit harvest is going to be increasingly difficult, as the other operations which help to support a labor force are mechanized.

The seasonal work force in Staislaus County has dwindled rapidly due to off-season unemployment. In 1964, the peach pickers were Mexican "greencards" specially recruited so as to be assured of a labor supply. Practically all the tomatoes were picked by "braceros." An even greater dependence on foreign labor is likely unless special recruitment programs are developed

<u>Results of the production and marketing phase of a study of the pecan industry were published</u>. This study was cooperative with the Marking Economics Division of ERS and the Agricultural Experiment Stations of Arkansas, Georgia, Mississippi, New Mexico, and South Carolina. Many pecan growers are now carrying out one or more orchard cultural practices; about 78 percent of all pecan acreage was fertilized. Labor requirements for producing pecans have decreased primarily as a result of increased mechanization, particularly in the harvest operation where pecans are shaken from the tree and picked up mechanically. Results of the study indicate that during the next decade, per capita supply of pecans will fluctuate around the present level, and the farm price will follow rising consumer incomes.

<u>An econometric study of factors affecting the demand for farm labor is cooperative with the Iowa Agricultural Experiment Station</u>. The study is regional and national in scope. Collection of time series for regression analysis was completed for the U. S. for the years 1938-1962, and for the 10 farm production regions from 1940-1962. A major activity this year has centered around the several series concerned with nonagricultural economic activity. In total, 35 time series for the U. S. and the 10 farm production regions were completed. These can be classified into seven groups: (1) Measures of labor used in agriculture, (2) variables indicating monetary returns in agriculture, (3) series measuring the activity and growth of nonfarm economic opportunities, (4) a group of variables showing the price of competing resources for labor, (5) several measures of technology, (6) variables indicating the price of commodities sold by farmers, and (7) ratios of many of the above economic variables. Regression estimates of demand for farm labor have been derived based on the time

series data. The results indicate that returns in agriculture, nonfarm economic activity, stock and price of farm machinery, and technology are significant factors in explaining the use of farm labor.

An additional activity which has been completed has been the gathering of data for the variables to be used in the cross-sectional analysis. Collection of data by State for 1953, 1958, 1960, 1961 and 1962 for many of the variables used in the time series analysis has been completed.

D. Economic Relationships Between Farm Operators and Hired Farm Workers

A study of the feasibility of alternative methods of providing housing for migrant farm workers, cooperative with Oregon State University, is in the final stages. Four areas of Oregon, differing with respect to labor-intensity of crops, seasonality of employment, and housing arrangements are being studied. A survey of growers, cam operators, and workers was completed in each of the four areas. The interview results have been tabulated and a report is being prepared. On-farm housing dominates in the tree fruit area and the strawberry-pole area. Off-farm grower association housing that is centrally located dominates in the less perishable row crop (sugar beet, onion, and potato) area. Preliminary findings indicate that cost per day per worker housed is most affected by the type of cropping area, as this influences the total number of days that camps are occupied annually. In the short-season cherry area, cost per day per worker housed is more than twice as great as in the long-season row crop area.

PUBLICATIONS -- USDA AND COOPERATIVE PROGRAMS

A. Farm Labor Requirements and Use

Farm Production Economics Division. 1964. Man-hours of labor used for farmwork, by groups of livestock and crops, for each farm production region, 1939-63. USDA Stat. Bul. 233, Supplement III. 12 pp.

Gavett, E. E. 1963. Truck crop production practices--Monterey County, California. ERS-129. 41 pp.

Gavett, E. E. 1964. Truck crop production practices--San Joaquin County, California. ERS-166. 50 pp.

Gavett, E. E. 1964. Truck crop production practices--Marion County, Oregon. ERS-169. 35 pp.

Gavett, E. E. 1964. Truck crop production practices--Yakima County, Washington. ERS-172. 42 pp.

Gavett, E. E. 1964. Labor used to produce vegetables, estimates by states, 1959. USDA Stat. Bul. No. 341. 37 pp.

Hecht, R. W. 1963. Labor used to produce livestock estimates by states, 1959. USDA Stat. Bul. No. 336. 21 pp.

McElroy, R. C., Hecht, R. W. and Gavett, E. E. 1964. Labor used to produce field crops, estimates by states. USDA Stat. Bul. No. 346. 43 pp.

B. Farm Labor Productivity and Efficiency

Farm Production Economics Division. 1964. Changes in farm production and efficiency. USDA Stat. Bul. No. 233, revised. 50 pp.

Farm Production Economics Division. 1964. Index numbers of farm production per man-hour, by groups of livestock and crops, for each farm production region, 1939-63. USDA Stat. Bul. No. 233, Supplement IV. 12 pp.

C. Economics of Farm Labor Utilization

McElroy, R. C. and Powell, J. V. 1963. Economic aspects of pecan production and marketing. AER-41. 42 pp.

Metzler, W. H. 1963. Relocation of the displaced worker. Human Organization 22(2), pp. 142-145.

Metzler, W. H. 1964. Helping displaced workers prepare for new jobs. Progressive Agriculture in Arizona 16(2).

D. Economic Relationships Between Farm Operators and Hired Farm Workers

None.

Line Project Check List -- Reporting Year Sept. 1, 1963 to Sept. 1, 1964

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in: Summary of Progress	Line Proj. Incl. in: Area & Subheading
FE 1	Farm capital, credit, and financial condition			
FE 1-1	Maintenance and improvement of farm-mortgage statistics	Washington, D.C.	Yes	4-B
FE 1-2	Production credit in agriculture--maintenance and improvement of statistics, and analysis of trends, terms, and problems	Washington, D.C.	Yes	4-C
FE 1-3	Operations of financial institutions that extend short- and intermediate-term credit to farmers	Washington, D.C. & Madison, Wis.	No	---
FE 1-4	Savings and investments of farm operators	Washington, D.C. & East Lansing, Mich.	Yes	4-C
FE 1-5	Balance sheet of agriculture and agricultural finance outlook	Washington, D.C.	Yes	4-A
FE 1-6	Relationship of supply and demand for long-term farm credit to adjustments in agriculture**	Lafayette, Ind.	No	---
FE 1-7	Cost, terms, and availability of credit for rural housing	Washington, D.C., Columbia, Mo., & Bozeman, Mont.	Yes	4-B
FE 1-8	Financing modern large-scale farming in Michigan	East Lansing, Mich.	No	---
FE 1-9	Effective use of capital and credit in agricultural adjustment in Wisconsin	Madison, Wis.	Yes	4-C
FE 2	Farmland values and valuation			
FE 2-1	Current developments in the farm real estate situation	Washington, D.C. & Urbana, Ill.	Yes	7-A&B
FE 2-2	Annual estimates and analysis of trends in farm real estate rentals	Washington, D.C.	Yes	7-C
FE 3	Agricultural risks and insurance			
FE 3-1	Improvement of farmers' mutual fire, windstorm, and crop-hail insurance company operations	Washington, D.C.	Yes	5-A
FE 3-2	Organized farm fire protection and estimation of annual farm fire losses	Washington, D.C.	Yes	5-B
FE 3-3	Casualty and life insurance (including social security) and accident prevention for farmers	Washington, D.C.	Yes	5-C
FE 3-4	Analysis of risks and risk-bearing in agricultural production	Washington, D.C. & Bozeman, Mont.	Yes	5-D
FE-0-0-1 (FCIC)	Economic impacts of Federal crop insurance*	Washington, D.C. & Bozeman, Mont.	Yes	5-D
FE 4	Agricultural taxation and rural government			
FE 4-1	Impact and economic effects of taxes on agriculture	Washington, D.C., Urbana, Ill., & Ithaca, N.Y.	Yes	6-A&B
FE 4-2	Organization and financing of local government in rural areas	Washington, D.C., St. Paul, Minn., & Ames, Iowa	Yes	6-C
FE 4-3	State-local fiscal structures and their relation to farm taxes	Washington, D.C. & Urbana, Ill.	Yes	6-A
FE 9	Agricultural adjustments and production response			
FE 9-1	Economic evaluation of forage production and utilization in New Hampshire	Durham, N.H.	Yes	2-A
FE 9-2 (rev.)	A study of farm organization and management problems in southeastern and southwestern Minnesota	St. Paul, Minn.	Yes	2-A
FE 9-3	Economic relationships between selected conservation practices and corn yields in western Iowa**	Ames, Iowa	No	---
FE 9-4	An economic evaluation of changes in use of farm lands within Wisconsin watershed projects	Madison, Wis.	Yes	2-B
FE 9-5	Economics of adjustments in beef production in the west	University Park, N. Mex., Ft. Collins, Colo., & Lincoln, Nebr.	Yes	1-G

*Initiated during reporting year. **Discontinued during reporting year.

Line Project Check List -- Reporting Year Sept. 1, 1963 to Sept. 1, 1964

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in: Summary of Progress	Line Proj. Incl. in: Area & Subheading
FE 9-7	Economics of adjustments in cotton producing areas in California	Davis, Calif.	Yes	1-D
FE 9-8	Adjustments in the economy of the Belle Fourche area and analysis of Newell Field Station experiments	Newell, S. Dak.	Yes	1-G
FE 9-9	An economic appraisal of adjustment opportunities in southern rice producing areas	Fayetteville, Ark., Baton Rouge, La., & College Station, Tex.	Yes	1-F
FE 9-10	Effects of alternative levels of grazing fees and privileges on ranch organization and net returns in public land areas	Washington, D.C. & selected States	Yes	1-G
FE 9-11	Adjustments in hog and beef cattle production in the Corn Belt to meet changing conditions--FE cooperation in Regional Project NC-54	Washington, D.C. & selected States	Yes	1-G & 4-C
FE 9-12	Economic appraisal of soil, water and crop practices on farm and ranch lands in the 17 western States	Ft. Collins, Colo.	No	---
FE 9-13	An economic appraisal of boll weevil damage and alternative methods of control	Washington, D.C. & selected States	Yes	2-A
FE 9-14	Economic appraisal of adjustments in Corn Belt farming to meet changing conditions	Washington, D.C. & selected States	Yes	1-G
FE 9-15	Economic appraisal of adjustments in dairy farming in the Lake States and adjoining areas to meet changing conditions	Washington, D.C. & selected States	Yes	1-C
FE 9-16	Economic appraisal of adjustments in dairy farming in the Northeast to meet changing conditions	Washington, D.C. & selected States	Yes	1-C
FE 9-17	Economics of adjustments on farms and production response in the Northern Plains wheat producing region	Washington, D.C. & selected States	Yes	1-E
FE 9-18	Production economics studies of agricultural production control programs	Washington, D.C. & selected States	Yes	1-H
FE 9-19	Analysis of agricultural production response	Washington, D.C. & selected States	Yes	1-B
FE 9-20	Economic appraisals of emerging technological developments in southern agriculture	Washington, D.C. & selected States	Yes	2-A&B
FE 9-21	An economic appraisal of emerging crop, livestock, and poultry technologies in the northern region	Washington, D.C. & selected States	Yes	2-A
FE 9-22	An economic appraisal of farming adjustment opportunities in the southeastern region to meet changing conditions	Washington, D.C. & selected States	Yes	1-D
FE 9-23	Economics of adjustments on farms and production response in the Southern Plains wheat producing region	Washington, D.C. & selected States	Yes	1-E
FE 9-24	Economics of adjustments on farms and production response in the Pacific Northwest wheat producing region	Washington, D.C. & selected States	Yes	1-E
FE 9-25	Farm management under conditions of variable output in the Great Plains	Bozeman, Mont.	Yes	2-A
FE 9-26	An economic appraisal of business survival probabilities of farms and ranches in the Great Plains area of Oklahoma	Stillwater, Okla.	Yes	2-A
FE 9-27	An economic appraisal of farming adjustment opportunities in the South Central region to meet changing conditions	Washington, D.C. & selected States	Yes	1-D 2-A&B
FE 9-28	Economic appraisal of regional adjustments in agricultural production and resource use to meet changing demand and technology	Washington, D.C. & selected States	Yes	1-B
FE 9-29	Long term projections for the production of agricultural commodities in the Pacific Northwest	Corvallis, Oreg.	Yes	1-A
FE 9-30	Economic analysis of production problems and adjustments on western range-livestock ranches	Washington, D.C. & selected States	Yes	1-G
FE 5-4	Economic evaluation of agricultural land drainage and related management of farms in Michigan **	East Lansing, Mich.	No	---

*Initiated during reporting year. **Discontinued during reporting year.

Line Project Check List -- Reporting Year Sept. 1, 1963 to Sept. 1, 1964

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in Summary of Progress	Line Proj. Incl. in Area Subheading
FE 10	Economics of farm size			
FE 10-1 (rev.)	Economic appraisal of minimum farm resources needed for specified farm income levels	Washington, D.C. & selected States	Yes	3-B
FE 10-2 (rev.)	Classification and analysis of kinds and sizes of farms	Washington, D.C.	Yes	3-B
FE 10-3	Effects of changes in size of farm on farm output and efficiency**	Washington, D.C.	No	---
FE 10-4	Optimum and feasible adjustments in size and number of farms in selected areas*	Washington, D.C. & selected States	Yes	3-B
FE P-1	Pioneering research in vertical coordination	Washington, D.C.	Yes	3-A
FE 11	Economics of farm labor resources and utilization			
FE 11-1	Maintenance and improvement of annual estimates of labor requirements in American agriculture	Washington, D.C.	Yes	10-A
FE 11-2	Measurement and analysis of labor productivity and efficiency in American agriculture	Washington, D.C.	Yes	10-B
FE 11-3	Labor and capital in selected crops and areas in California	Washington, D.C. & Davis, Calif.	Yes	10-C
FE 11-5	Economic and related aspects of providing housing for migrant hired farmworkers	Washington, D.C. & Corvallis, Oreg.	Yes	10-D
FE 12	Economics of technological changes in farming			
FE 12-1	Measurement and analysis of progress in farm mechanization	Washington, D.C.	No	---
FE 12-2 (rev.)	National survey and analysis of selected farm production practices	Washington, D.C.	Yes	8-E
FE 12-3	Maintenance and improvement of annual estimates of feed consumption and animal units in the U. S.	Washington, D.C.	Yes	8-D
FE 12-6	Economic interpretation of yield response to fertilizer and associated technology	Washington, D.C.	Yes	8-C
FE 12-7	The farm demand for fertilizer, machinery, and structures	Washington, D.C., Ames, Iowa, & East Lansing, Mich.	Yes	8-A 8-B 8-C
FE 12-9	Economic evaluation of pasture production	Washington, D.C.	Yes	8-D
FE 13	Farm output and resource productivity			
FE 13-1	Maintenance, improvement and analysis of overall measures of farm production	Washington, D.C.	Yes	1-A
FE 13-2	Measurement and analysis of changes in resources used, and efficiency of resource use, in agriculture	Washington, D.C.	Yes	1-A
FE 13-3	Appraisal of the influence of weather on crop yields and production	Washington, D.C.	Yes	1-A
FE 13-4	Appraisal of farm production prospects and resource needs	Washington, D.C.	Yes	1-A
FE 14	Farm costs and returns			
FE 14-1	Annual estimates and analyses of changes in costs, returns, and farm organization on commercial family-operated farms by type and size	Washington, D.C.	Yes	9-A
FE 14-2	Preparation of "Farm Cost Situation" reports	Washington, D.C.	Yes	9-A
FE 14-3	Costs and returns on commercial poultry farms (egg and broiler) in the Northeastern, Middle Atlantic, and Southeastern States	Washington, D.C.	Yes	9-A

*Initiated during reporting year. **Discontinued during reporting year.